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The State of Mediterranean and Black Sea Fisheries 2020

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Foreword

For millennia, fisheries have driven the blue economy of the Mediterranean and the Black Sea, providing essential coastal livelihoods and the basis for the so-called "Mediterranean diet." Ever since the search for new fishing and trading opportunities led the Romans and Phoenicians to establish routes across the region, these fisheries have promoted the expansion of civilizations and encouraged cultural exchange.

Feeding and providing livelihoods for an exponentially expanding world population, while striving to reduce inequality and support gender equity, represent the main challenges of our era and the ultimate targets of the United Nations Sustainable Development Goals. In the Mediterranean and the Black Sea, maintaining high levels of sustainable yield and providing for livelihoods remains a particularly tall order. The countries of the region are characterized by densely populated coastal areas and are among the countries of the world with the highest demand for fish protein. Together, these factors impose intense pressure on Mediterranean and Black Sea ecosystems, which already face unique challenges due to their semi-enclosed nature and little connection to other oceans.

Since the 1980s and 1990s, the toll of various human pressures on the Mediterranean and Black Sea environment, ecosystems and living resources, and ultimately the impact of these pressures on the fishing sector, has been obvious. Collapses in stocks, large eutrophication events in both basins and the appearance of prodigious numbers of non-indigenous species were occurring across the region by the late 1990s and 2000s. Before long, other warning signs were added to the list of threats already evident: the extent of plastic pollution, ghost fishing and the various impacts of climate change, which include an overall warming of the sea, greater frequency of extreme warm or cold events in the upper layers of the ocean, increases in drought periods and decreases in river inflow.

Recognition of these challenges at the global and local scale impelled countries and international organizations to act, revising existing strategies and creating new ones when needed. In this context, the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO) and all its members have stepped up to the task of reversing the concerning trends seen in the region. In response to the advice of externally conducted performance reviews, the most recent of which was completed in 2019, the GFCM has adapted its institutional framework to represent a more modern and agile Commission better able to respond to the challenges facing the region. These amendments also prompted the adoption of the mid-term strategy (2017–2020) towards the sustainability of

Mediterranean and Black Sea fisheries, which included ambitious targets to improve scientific knowledge and data collection on the most pressing issues facing the region's fisheries and facilitate the adoption of effective management measures.

This third issue of *The State of the Mediterranean and Black Sea Fisheries* coincides with the final year of the mid-term strategy. The commitment of the GFCM in the context of this strategy to increase the quality and quantity of data is evident in the unprecedented depth of analysis and technical insight presented in this edition. While it may take time to witness the full impacts of the measures adopted and activities carried out over the last few years, this 2020 edition highlights the great progress already made toward reversing the negative trends observed in our fisheries.

The State of the Mediterranean and Black Sea Fisheries aims to provide a guide for relevant stakeholders to understand the region's dynamic fishing sector, make strategic decisions and monitor their consequences. We are confident that beyond detailing past advances, this publication also shows the way forward. In 2020, discussions over a new strategy have been launched, and by early 2021, the adoption of a new common vision and guiding principles is foreseen in order to consolidate the progress made thus far and to accelerate our common efforts to promote the sustainability of the Mediterranean and the Black Sea.

We hope that this new edition of *The State of the Mediterranean and Black Sea Fisheries* satisfies the readers' need for information and helps the GFCM to continue advancing towards achieving its goals.

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
AIS	Automatic identification system
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CDS	Catch documentation scheme
CL	Carapace length
CPCs	Contracting parties and cooperating non-contracting parties
DCRF	Data Collection Reference Framework (GFCM)
EAF	Ecosystem approach to fisheries
EFH	Essential fish habitat
F	Fishing mortality
FAD	Fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
FRA	Fisheries restricted area
FTE	Full-time equivalent
GFCM	General Fisheries Commission for the Mediterranean
GIS	Geographical information system
GSA	Geographical subarea
GT	Gross tonnage
GVA	Gross value added
HoReCa	Hotel, restaurant and catering (sector)
HP	Horsepower
ILO	International Labour Organization
ISSCAAP	FAO International Standard Statistical Classification for Aquatic Animals and Plants
IUCN	International Union for Conservation of Nature
IUCN-Med	International Union for Conservation of Nature – Centre for Mediterranean Cooperation
IUU	Illegal, unreported and unregulated (fishing)
LOA	Length overall
LLS	Set longlines
MCS	Monitoring, control and surveillance
MEDASSET	Mediterranean Association to Save the Sea Turtles
MPA	Marine protected area
MSE	Management strategy evaluation
MSY	Maximum sustainable yield
NIS	Non-indigenous species
OTB	Bottom trawler
RF	Recreational fisheries
ROV	Remotely operated underwater vehicle
RPOA-SSF	Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea
SAC	Scientific Advisory Committee on Fisheries
SAF	Stock assessment form
SAI	Significant adverse impacts

SCAA	Statistical catch-at-age method
SGSABS	Subregional Group on Stock Assessment in the Black Sea
SPA/BD Protocol	Protocol concerning specially protected areas and biological diversity in the Mediterranean
SPA/RAC	Specially Protected Areas Regional Activity Centre
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
STB	Standardized trade balance
SWOT	Strengths, weaknesses, opportunities and threats
TAC	Total allowable catch
TL	Total length
UNEP/MAP	United Nations Environment Programme/Mediterranean Action Plan
VME	Vulnerable marine ecosystem
VMS	Vessel monitoring system
WGBS	Working Group on the Black Sea
WGRF	Working Group on Recreational Fisheries
WGMPA	Working Group on Marine Protected Areas
WGSSF	Working Group on Small-Scale Fisheries
XSA	Extended survivor analysis

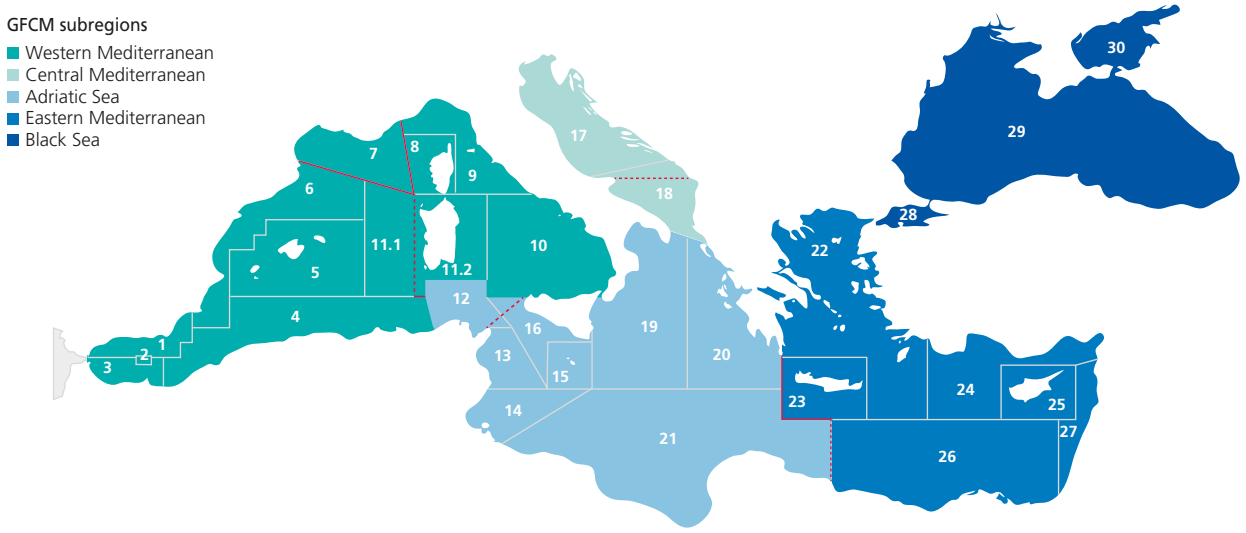
Introduction and methodology

Since ancient times, the Mediterranean and the Black Sea (FAO major fishing area 37) have sustained important fishing activities. Today, industrial, semi-industrial and small-scale fisheries coexist in the region, using a wide variety of fishing gear. In contrast to other major fishing areas, and with just a few exceptions, Mediterranean and Black Sea fisheries are generally multispecies, exploiting a variety of benthic and pelagic stocks of fish, as well as of molluscs and crustaceans. In addition, owing to the semi-enclosed nature of the Mediterranean and the Black Sea, stocks are often shared among fleets from different countries, meaning that the fishery sector plays an important connecting role in the region. Indeed, despite the relatively low economic output of fisheries compared to other economic activities in the region (e.g. tourism, oil and gas exploration), the annual production of roughly 1.2 million tonnes offers employment opportunities to several hundred thousand people, supplies seafood products for human consumption to local, regional and international markets, and creates many other indirect benefits, thereby maintaining the social fabric of many coastal communities. As such, fisheries are an intrinsic part of the cultural landscape of Mediterranean and Black Sea countries.

Numerous factors threaten the sustainability of Mediterranean and Black Sea fisheries, including increased pollution from human activities, habitat degradation, the introduction of non-indigenous species, overfishing and the impacts of climate-driven changes on the marine environment and its ecosystems. The dramatic ecosystem changes that have recently occurred, especially in the Black Sea over the past few decades, confirm the urgency of responding to these different processes and stressors when managing fisheries in the region, in line with an ecosystem approach to fisheries.

Recognizing the importance and peculiarities of fisheries in the Mediterranean and the Black Sea and the need for strong regional cooperation, the General Fisheries Commission for the Mediterranean (GFCM) was established under Article XIV of the Constitution of the Food and Agriculture Organization of the United Nations (FAO) to promote the development, conservation, rational management and best utilization of marine living resources

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



FAO statistical divisions — GFCM geographical subareas (GSAs)

Source: GFCM, 2018.

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 Gabès	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

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, to provide a basis for the formulation of scientific and management advice conducive to sustainable and responsible fisheries.

This report is the third issue of the GFCM biennial series on *The State of Mediterranean and Black Sea Fisheries*. The series was established following requests from the contracting parties to the regional fisheries management organization active in the area, the GFCM. It has become the reference document on the status of Mediterranean and Black Sea marine resources and fisheries, as well as a tool for monitoring progress towards achieving GFCM objectives and for supporting strategic decision-making. *The State of Mediterranean and Black Sea Fisheries* also complements the FAO global reference series *The State of World Fisheries and Aquaculture*, holding a magnifying glass over FAO major fishing area 37 (Mediterranean and Black Sea).

The State of Mediterranean and Black Sea Fisheries 2020 follows the same organization as previous issues, consisting of seven chapters, divided into two parts. The first part provides an overview of status and trends, describing the current composition of the fishing fleet (Chapter 1), the overall capture fisheries 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 fishery resources (Chapter 5). The second part focuses on fisheries governance and the implementation of strategic initiatives, with insights on small-scale fisheries (Chapter 6) and fisheries management measures put in place by the GFCM to support the sustainability of fisheries and the conservation of vulnerable marine ecosystems and species (Chapter 7).

TABLE 1. Main species analysed in *The State of Mediterranean and Black Sea Fisheries*: priority species driving fisheries and for which assessments are regularly carried out

		GFCM subregions →	Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
		GSAs →	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	12, 13, 14, 15, 16, 19, 20, 21	17, 18	22, 23, 24, 25, 26, 27	28, 29, 30
		Countries →	Algeria, France, Italy, Monaco, Morocco, Spain	Italy, Greece, Libya, Malta, Tunisia	Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, Slovenia	Cyprus, Egypt, Greece, Israel, Lebanon, Syrian Arab Republic, Turkey	Bulgaria, Georgia, Romania, Turkey, Ukraine, Russian Federation
Scientific name	Common name						
Pelagic species							
Engraulis encrasicolus	European anchovy		X	X	X	X	X
Sardina pilchardus	Sardine		X	X	X	X	
Sardinella aurita	Round sardinella		X	X		X	
Sprattus sprattus	European sprat						X
Trachurus mediterraneus	Mediterranean horse mackerel						X
Demersal species							
Aristaeomorpha foliacea	Giant red shrimp			X		X	
Aristeus antennatus	Blue and red shrimp			X		X	
Merlangius merlangus	Whiting						X
Merluccius merluccius	European hake		X	X	X	X	
Mullus barbatus	Red mullet		X	X	X	X	
Mullus surmuletus	Surmullet		X	X		X	
Nephrops norvegicus	Norway lobster		X	X	X		
Pagellus bogaraveo	Blackspot seabream		X				
Parapenaeus longirostris	Deep-water rose shrimp		X	X	X	X	
Rapana venosa	Rapa whelk						X
Scophthalmus maximus	Turbot						X
Sepia officinalis	Common cuttlefish				X		
Solea solea	Common sole				X		
Squalus acanthias	Piked dogfish						X
Squilla mantis	Spottail mantis shrimp				X		
Additional species							
Anguilla anguilla	European eel		X	X	X	X	
Corallium rubrum	Red coral		X	X	X	X	
Coryphaena hippurus	Common dolphinfish			X	X	X	
Sarda sarda	Atlantic bonito						X
Saurida lessepsianus	Lizardfish					X	

Note: adapted from the DCRF Manual (see Box 1).

The report presents data and information mostly up to 2018, although when possible, 2019 information is also included. It is based on data officially submitted by GFCM contracting parties and cooperating non-contracting parties (CPCs) in line with binding decisions (GFCM, 2019a) and through the online platform of the GFCM Data Collection Reference Framework (DCRF; Box 1), FAO official fishery statistics (e.g. FAO fisheries commodities production and trade statistics), the GFCM database on stock assessment form metadata, the STATLANT

TABLE 2. Main species analysed in *The State of Mediterranean and Black Sea Fisheries*: important species in terms of landings and/or economic value at the regional and subregional levels and for which assessments are not regularly carried out

		GFCM subregions →	Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
		GSAs →	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	12, 13, 14, 15, 16, 19, 20, 21	17, 18	22, 23, 24, 25, 26, 27	28, 29, 30
		Countries →	Algeria, France, Italy, Monaco, Morocco, Spain	Italy, Greece, Libya, Malta, Tunisia	Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, Slovenia	Cyprus, Egypt, Greece, Israel, Lebanon, Syrian Arab Republic, Turkey	Bulgaria, Georgia, Romania, Turkey, Ukraine, Russian Federation
Scientific name	Common name						
Alosa immaculata	Pontic shad						X
Boops boops	Bogue		X	X	X	X	
Chamelea gallina	Striped venus				X		
Diplodus annularis	Annular seabream			X			
Eledone cirrhosa	Horned octopus		X		X		
Eledone moschata	Musky octopus				X		
Galeus melastomus	Blackmouth catshark		X				
Lophius budegassa	Blackbellied angler		X	X			
Micromesistius poutassou	Blue whiting		X				
Octopus vulgaris	Common octopus		X	X	X	X	
Pagellus erythrinus	Common pandora		X	X	X	X	
Raja asterias	Mediterranean starry ray		X				
Raja clavata	Thornback ray		X	X			
Saurida undosquamis	Brushtooth lizardfish					X	
Scomber japonicus	Pacific chub mackerel		X			X	
Scomber scombrus	Atlantic mackerel		X	X			
Siganus luridus	Dusky spinefoot					X	
Siganus rivulatus	Marbled spinefoot					X	
Sphyraena sphyraena	European barracuda			X			
Spicara smaris	Picarel				X	X	
Trachurus picturatus	Blue jack mackerel		X				
Trachurus trachurus	Atlantic horse mackerel		X	X		X	

Note: adapted from the DCRF Manual (see Box 1).

system of questionnaires developed by the FAO Coordinating Working Party on Fishery Statistics, 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. A brief description of the data sources and the methods used for the different analyses is available at the beginning of each chapter.

Throughout the report, data are analysed at different levels of aggregation. Particular attention is paid to addressing the main vessel categories, called "fleet segment groups" in Chapters 1 through 3, as the analysis in these chapters stems

TABLE 3. Main species analysed in *The State of Mediterranean and Black Sea Fisheries*: species subject to international/national management plans and to recovery or conservation action plans and non-indigenous species with the greatest potential impacts

		GFCM subregions →	Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
		GSAs →	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	12, 13, 14, 15, 16, 19, 20, 21	17, 18	22, 23, 24, 25, 26, 27	28, 29, 30
		Countries →	Algeria, France, Italy, Monaco, Morocco, Spain	Italy, Greece, Libya, Malta, Tunisia	Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, Slovenia	Cyprus, Egypt, Greece, Israel, Lebanon, Syrian Arab Republic, Turkey	Bulgaria, Georgia, Romania, Turkey, Ukraine, Russian Federation
Scientific name	Common name						
Dalatias licha	Kitefin shark		X	X	X	X	
Dipturus oxyrinchus	Longnosed skate		X	X	X	X	
Etmopterus spinax	Velvet belly		X	X	X	X	
Galeus melastomus	Blackmouth catshark			X	X	X	
Hexanchus griseus	Bluntnose sixgill shark		X	X	X	X	
Mustelus asterias	Starry smooth-hound		X	X	X	X	
Mustelus mustelus	Smooth-hound		X	X	X	X	
Mustelus punctulatus	Blackspotted smooth-hound		X	X	X	X	
Myliobatis aquila	Common eagle ray		X	X	X	X	
Prionace glauca	Blue shark		X	X	X	X	
Pteroplatytrygon violacea	Pelagic stingray		X	X	X	X	
Raja miraletus	Brown ray		X	X	X	X	
Scyliorhinus canicula	Small-spotted catshark		X	X	X	X	X
Scyliorhinus stellaris	Nursehound		X	X	X	X	
Squalus blainville	Longnose spurdog		X	X	X	X	
Torpedo marmorata	Marbled electric ray		X	X	X	X	
Torpedo torpedo	Common torpedo		X	X	X	X	
Fistularia commersonii	Bluespotted cornetfish					X	
Lagocephalus sceleratus	Silver-cheeked toadfish		X	X	X	X	
Marsupenaeus japonicus	Kuruma prawn					X	
Metapenaeus stebbingi	Peregrine shrimp					X	
Pterois miles	Devil firefish		X	X	X	X	
Scomberomorus commerson	Narrow-barred Spanish mackerel					X	

Note: adapted from the DCRF Manual (see Box 1).

from official data submitted according to the DCRF fleet segments (Box 1). Chapter 4 uses slightly different and more generic categories called "vessel groups," as the analysis in this chapter originates from a more heterogeneous source of data including a literature review. Data are also aggregated and analysed by species, in line with the lists of the main species of commercial or conservation interest (available in Table 1, Table 2 and Table 3, adapted from the DCRF, taking into account the species analysed in this report). Analyses are provided at different spatial scales, mainly addressing the regional, subregional and national levels. At the regional scale, summaries 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 offers 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 policymakers 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. at the level of geographical subareas, commonly used in the GFCM as the smallest management unit.

Since the first trimester of 2020, the COVID-19 pandemic has had an impact on human activities in the Mediterranean and Black Sea, including on fishing and fisheries-related monitoring activities. The impacts do not affect the activities and analyses reported in this issue of *The State of Mediterranean and Black Sea Fisheries*, although they have caused some delays in the reporting of data from CPCs. A brief preliminary analysis of the immediate impacts of the COVID-19 pandemic on Mediterranean and Black Sea fisheries is briefly summarized in this report (Box 16), although a more comprehensive analysis, covering both immediate impacts and medium-term effects is expected to be conducted for the next edition of the publication in 2022.

Box1. The GFCM Data Collection Reference Framework

The GFCM Data Collection Reference Framework (DCRF) is the 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 on 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 the 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 (by fleet segment, fishing gear, catch per unit effort), 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).

Contracting parties and cooperating non-contracting parties are equipped with dynamic tools to facilitate the collection and submission of data:

- 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.
- 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 has been conceived as a flexible tool, to be regularly reviewed in light of possible new GFCM requirements, including newly adopted recommendations. As such, 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.

In 2020, the new recurring fisheries data requirements of the GFCM, which were not yet part of the DCRF, began to be progressively incorporated into the DCRF itself on an annual basis through the so-called "harmonization process of the DCRF". Therefore, the dedicated data-entry and quality checking tools, the online data transmission procedures and the DCRF manual, with the related tables and list of fields and definitions, were progressively released and subsequently made available to the CPCs involved.

Executive summary

This report is the third issue of the biennial series *The State of Mediterranean and Black Sea Fisheries* prepared by the General Fisheries Commission for the Mediterranean (GFCM). It follows the same organization as the previous editions, consisting of seven chapters, divided into two parts. The first part provides an overview of status and trends, describing the current composition of the fishing fleet (Chapter 1), the overall capture fisheries 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 fishery resources (Chapter 5). The second part focuses on fisheries governance and the implementation of strategic initiatives, with insights into small-scale fisheries (Chapter 6) and fisheries management measures put in place by the GFCM to support the sustainability of fisheries and the conservation of vulnerable marine ecosystems and species (Chapter 7).

The State of Mediterranean and Black Sea Fisheries 2020 presents primarily data and information collected up to 2018, although when possible, 2019 information is also included. It is based on data officially submitted by GFCM contracting parties and cooperating non-contracting parties (CPCs) in line with binding decisions and through a number of established data submission tools. In the absence of national reporting, estimates were made based on the best available data obtained from other sources or through standard methodologies. A brief description of the data sources and the methods used for the different analyses is available at the beginning of each chapter.

This report also provides a brief preliminary analysis of the immediate impacts of the COVID-19 pandemic on Mediterranean and Black Sea fisheries (Box 16), although a more comprehensive analysis is expected to be conducted for the next issue of *The State of Mediterranean and Black Sea Fisheries* in 2022.

The main highlights of the 2020 report are summarized below.

STATUS OF THE FISHING FLEET

The fishing fleet in operation in the GFCM area of application (the Mediterranean and the Black Sea) in 2019 consists of 87 600 fishing vessels and a total fishing capacity of around 903 000 gross tonnage, with both quantities having remained relatively constant over the last two years. Four countries (Turkey, Tunisia, Greece and Italy) account for around 60 percent of the total fishing fleet. Nearly 4 150 fishing vessels operate within the context of nine GFCM fishery management plans, with 164 vessels operating in two GFCM fisheries restricted areas (FRAs), in the Jabuka/Pomo Pit and the Gulf of Lion. Romania has the youngest fleet, with an average vessel age of 13 years old, followed by Morocco (14 years old), Egypt (15 years old) and Algeria (20 years old). By contrast, the oldest fishing vessels are from Israel (46 years old), Slovenia (41 years old), Croatia (39 years old) and Albania (38 years old).

Small-scale vessels continue to account for around 83 percent of the fishing fleet in operation in the Mediterranean and the Black Sea with 71 400 fishing vessels, followed by demersal trawlers (6 700 vessels, 7.8 percent), purse seiners and pelagic trawlers (4 300 vessels, 5.1 percent) and other fleet segments (3 600 vessels, 4.2 percent).

The Mediterranean Sea hosts 76 280 fishing vessels (87 percent of the whole fleet). The largest shares of the fleet are in the eastern Mediterranean (30.6 percent) and central Mediterranean (23.2 percent). Small-scale vessels represent the predominant fleet segment group in all four of the Mediterranean subregions (82.1 percent on average), with the highest numbers in the central and eastern Mediterranean. They are followed in order of importance by the fleet segment group of trawlers and beam trawlers, particularly in the Adriatic Sea, as well as in the western and eastern Mediterranean, then purse seiners and pelagic trawlers, especially numerous in the western Mediterranean Sea.

The Black Sea and Marmara Sea area accounts for 11 360 fishing vessels (13 percent of the whole fleet in the GFCM area of application), with the large majority of them (81.2 percent, 9 200 fishing vessels) operating in the Black Sea. The prevalence of small-scale vessels is higher in the Black Sea (9 981 vessels, 88.2 percent) compared to the GFCM area of application as a whole.

CAPTURE FISHERIES PRODUCTION

The combined landings for the GFCM area of application (the Mediterranean and the Black Sea) in 2018 (2016–2018 average) amount to 1 175 700 tonnes (excluding tuna-like species), i.e. 2.7 percent greater than the landings in 2016 (2014–2016 average) as reported in the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018). Turkey is the main producer (274 000 tonnes, 23.3 percent of the total), followed by Italy (178 700 tonnes, 15.2 percent) and Algeria (103 000 tonnes, 8.8 percent). Purse seiners and pelagic trawlers continue to be the fleet segment groups responsible for the largest share of total landings (50.7 percent), as the catch remains largely dominated by small pelagic fish (mainly European anchovy, with 333 340 tonnes, and sardine, with 185 700 tonnes). They are followed by trawlers (23.2 percent), small-scale vessels (15 percent) and other fleet segments (11.2 percent of the total).

The Black Sea is responsible for 33 percent of the landings (387 844 tonnes), while the remaining 67 percent (788 000 tonnes) occurring in the Mediterranean are distributed between the GFCM subregions as follows: 22 percent come from the western area (258 300 tonnes), while the central and eastern Mediterranean and the Adriatic Sea contribute similar shares of around 15 percent each to the region's total catch (ranging between 170 000 to 180 000 tonnes). The ten main ports in terms of the volume of landings in the entire GFCM area, accounting for around 15 percent of the total landings, are concentrated in only five countries bordering the Black Sea and the southern Mediterranean: Turkey, Georgia, Egypt, Tunisia, and Algeria.

In the Mediterranean, the largest increase in catch since 2016 was shown by Turkey (+20.4 percent), while the greatest decrease was shown by Morocco (-10.6 percent). In the Black Sea, Georgia and Romania showed the most evident increase from 2016 (+79 percent and +73.9 percent, respectively), whereas Turkey's contribution to Black Sea landings decreased by around 13 percent.

Landings of priority small pelagic species showed large and frequent fluctuations, though current landings are much lower than previously achieved maxima. For priority demersal species, European hake, whiting, Norway lobster and

turbot have showed continuous declines in catch since the 1980s–1990s, while sole showed an abrupt decline in the late 1990s and landings have remained low since then. Mullets, as well as priority molluscs (common cuttlefish, rapa whelk) and most of the crustacean species (spottail mantis shrimp, deep-water rose shrimp, blue and red shrimp, and giant red shrimp), show a generally increasing trend, though a few have experienced some fluctuations in recent years. On the other hand, for species of conservation concern, such as European eel and piked dogfish, a steep decline in catch, with very close to zero catch in recent years, has been observed.

SOCIO-ECONOMIC CHARACTERISTICS

Total revenue (value at first sale) from marine capture fisheries in the GFCM area of application is estimated at USD 3.6 billion in 2018 (USD 3.4 billion in the Mediterranean and USD 251 million in the Black Sea), representing an increase of approximately USD 300 million since 2016[1]. Six countries, namely Italy, Greece, Turkey, Spain, Algeria and Tunisia, account for 83 percent of total revenue. The wider economic impact of fisheries in the region, including direct, indirect and induced effects, is estimated to be 2.6 times the value at first sale (FAO, 2018), or approximately USD 9.4 billion.

Twenty-two species represent over 70 percent of the total landing value in the Mediterranean and just eight species represent over 90 percent of the total landing value in the Black Sea.

Capture fisheries in the GFCM area of application support approximately 785 000 jobs. This figure includes those directly employed onboard fishing vessels in full- and part-time roles (225 000 jobs, a relative stagnation since 2016), as well as an estimate of those employed in the pre- and post-harvest sectors. Six countries (Tunisia, Algeria, Turkey, Greece, Egypt and Italy) account for 82 percent of total employment onboard fishing vessels.

It is estimated that on average in the Mediterranean and Black Sea region, one in every 1 000 coastal residents is a fisher. In some countries, like Tunisia, Croatia and Morocco, this number can reach as high as one in every 95–200 coastal residents. Across the region, the workforce is aging, with close to half of all crew members over the age of 40, while only 17 percent are under the age of 25.

Preliminary data on the destination of catch at first sale show that while most industrial catch is sold via auction or wholesalers, the small-scale fisheries (SSF) sector clearly depends on shorter value chains, with direct sales to final consumers, hotels, restaurants and fishmongers representing over 42 percent of sales by value. Nevertheless, the fish trade remains an important activity and the value of traded fish products (imports plus exports) in the GFCM area of application amounts to USD 41.7 billion (over 11 times the revenue at first sale). Mediterranean and Black Sea countries tend to import more fish than they export; only six countries (Morocco, Tunisia, Turkey, Albania, Croatia and Greece) are net exporters. Furthermore, there seems to be a direct correlation between a country's income level and its trade balance, with lower-income countries tending to export more and higher-income countries importing more.

BYCATCH: DISCARDS AND INCIDENTAL CATCH OF VULNERABLE SPECIES

The volume of fishery discards in the Mediterranean, as estimated in *The State of Mediterranean and Black Sea Fisheries 2018* (FAO, 2018), is around 230 000 tonnes per year, or around 18 percent of the total catch. In the Black Sea, discards are estimated at around 45 000 tonnes or around 10–15 percent of the catch. The bottom trawl fishery is responsible for the majority of this figure in all geographical subareas, while SSF, by contrast, tend to have discard rates below 10 percent.

In recent years, from a strictly numerical point of view, sea turtles have represented the highest share of total reported incidental catch of vulnerable species, followed by sharks and rays. Seabirds and marine mammals, by contrast, are the two groups least reported as bycatch. In terms of species by vulnerable group, the most commonly reported incidents involve the loggerhead turtle (*Caretta caretta*) among sea turtles and the sandbar shark (*Carcharinhus plumbeus*), the smooth-hound shark (*Mustelus mustelus*) and the blackchin guitarfish (*Rhinobatos*

[1] Adjusted for inflation and calculated as constant 2018 USD.

cemiculus) among sharks and rays. The most frequently reported species of marine mammals as bycatch are the striped dolphin (*Stenella coeruleoalba*) in the Mediterranean and the harbour porpoise (*Phocoena phocoena relicta*) in the Black Sea. Meanwhile, two of the most threatened seabirds in Europe, the Balearic shearwater (*Puffinus mauretanicus*) and the Yelkouan shearwater (*Puffinus yelkouan*), both endemic to the Mediterranean, are particularly vulnerable.

Bottom trawlers and drifting and set longliners are by far the most relevant vessel groups impacting conservation-priority species in the whole region.

STATUS OF FISHERY RESOURCES

There has been an overall improvement in the coverage of advice on the status of resources in the Mediterranean and Black Sea; currently, advice is available for around 85 management units, reaching nearly 50 percent of the catch and covering 26 out of the 30 geographical subareas.

In recent years, there has been a decrease in the percentage of stocks in overexploitation (from 88 percent in 2012 to 75 percent in 2018), as well as in the average exploitation ratio, which has decreased from 2.9 to 2.4 times the maximum sustainable yield fishing mortality over the same period. Taking into account newly assessed stocks, the percentage of stocks with high relative biomass (46 percent) has doubled compared to *The State of Mediterranean and Black Sea Fisheries 2018* (23 percent); of the stocks common to both editions (FAO, 2016, 2018), six have shown an improvement in biomass levels and only two have declined.

For priority species, a decrease in the exploitation ratio is also obvious for a number of species, such as European hake, common sole and turbot, while others, such as blue and red shrimp, Norway lobster and sardine, have shown an increase in exploitation ratios. For some stocks of the iconic species European hake and turbot, the improvement is apparent both in terms of decreasing exploitation and increasing biomass.

INSIGHTS INTO SMALL-SCALE FISHERIES AND RECREATIONAL FISHERIES

Small-scale fisheries are a crucial subsector of fisheries in the Mediterranean and Black Sea region, representing 83 percent of the fleet, 57 percent of employment onboard vessels, 29 percent of revenue and 15 percent of catch. However, small-scale fishers remain a highly vulnerable group, often with limited access to social protection programmes and financial services and limited capacity to respond to, or plan for, adverse events.

While most countries have fairly complete data on the number of SSF vessels in their fleets, more work is needed to ensure adequate monitoring of the catch from these vessels. Only half of CPCs require all SSF vessels to report landings at designated landing ports and only 40 percent require all SSF to use self-reporting tools such as logbooks. All but one country (i.e. 95 percent) collect data on vessel-based SSF employment, while a majority also collect gender-disaggregated data. However, only 30 percent of countries collect data on employment in non-vessel-based SSF activities, such as gleaning.

Social protection programmes play an important role in improving the resilience of the SSF sector in the face of adverse shocks, such as the COVID-19 crisis. Contracting parties and cooperating non-contracting parties boast relatively high coverage of both health insurance and old age pensions, two social protection programmes that have been found to be highly valued by small-scale fishers. On the other hand, small-scale fishers generally have limited access to unemployment insurance programmes, although a surge of temporary, ad hoc unemployment schemes have emerged in the wake of the COVID-19 crisis.

FISHERY MANAGEMENT MEASURES

Significant advances have been made by the GFCM in terms of managing fisheries resources. Since the last issue of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018), five new management plans, two regional and three subregional, have been approved, four existing ones revised, and four recommendations outlining

new management measures or updating existing ones have been adopted. There are currently ten active management plans addressing key Mediterranean and Black Sea stocks, which include a wide variety of management measures, such as minimum landing size, catch limits, ad hoc spatial and temporal closures to allow for the recovery of stocks and the creation of refugia zones, reductions of the fishing effort, etc.

GFCM research programmes are being launched to address data and management issues for rapa whelk, European eel, red coral and blue crab. These programmes not only allow for the collection of scientific data in support of new and/or enhanced fisheries management measures, but also provide a platform of cooperation and networking towards capacity building and the effective cooperative management of shared resources.

Important steps have been taken towards the spatial management of fisheries resources, with the launch of monitoring plans for FRAs, the determination of the fishing footprint of certain fisheries, the identification of vulnerable marine ecosytems (VMEs) and VME indicator species hotspots and the collation of existing data into an analytical and dynamic database on sensitive benthic habitats and species. A first assessment of advances in relation to monitoring the impact on the Jabuka/Pomo Pit FRA has provided promising results and defined the main elements for future monitoring plans.

The first signs of recovery observed for some fisheries, e.g. turbot in the Black Sea and, to a certain extent, European hake in the Mediterranean, are likely to be related to increased management measures implemented in the Mediterranean and the Black Sea in recent years, particularly through the adoption of several management plans. However, additional efforts are still required to adequately achieve sustainability, especially in the face of a changing environment, notably through improved dedicated adaptive management plans featuring socio-economic and climate change measures, as well as additional spatial measures.

PART 1

Status and trends of Mediterranean and Black Sea fisheries

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1. Status of the fishing fleet

This chapter includes the most up-to-date information on the fishing fleet operating in the GFCM area of application. Analyses take into consideration key aspects of the fishing vessels in the Mediterranean Sea (geographical subareas (GSAs) 1 to 27), Marmara Sea and Black Sea (GSAs 28 and 29), including size, capacity, engine power and age, as well as the composition of fleet segments (defined as the intersections between all predefined vessel groups and length classes). Also reported in this chapter are the characteristics of the fishing fleet in the context of current GFCM management plans[2] and of fisheries restricted areas (FRAs)[3], areas in which fishing activity is regulated by different types of restrictions and temporal limitations.

The data and information used in this chapter are mainly sourced from binding GFCM recommendations requiring 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 of Recommendations GFCM/33/2009/5 on the establishment of the GFCM regional fleet register and GFCM/33/2009/6 concerning

[2] Blackspot seabream (*Pagellus bogaraveo*) fishery in the Alboran Sea, demersal fisheries in the Adriatic Sea and the Strait of Sicily, small pelagic fisheries in the Adriatic Sea, sustainable exploitation of red coral (*Corallium rubrum*), sustainable trawl fisheries in the Ionian Sea and the Levant Sea, and turbot (*Scophthalmus maximus*) fisheries in the Black Sea.

[3] Jabuka/Pomo Pit (Adriatic Sea) and Gulf of Lion FRAs.

the establishment of a GFCM record of vessels over 15 m authorized to operate in the GFCM area of application, amending Recommendation GFCM/29/2005/2[4]. The data, as transmitted by CPCs, are stored in the GFCM vessel records database (containing data on the fleet register and on operating fleets 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 currently in operation, while in some countries, the national fleet register does not contain complete data on small-scale vessels.

- The second group of GFCM decisions consists of Recommendations GFCM/33/2009/3 on the implementation of the GFCM Task 1 statistical matrix and repealing Resolution GFCM/31/2007/1; GFCM/40/2016/2 on the progressive implementation of data submission in line with the GFCM Data Collection Reference Framework; 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; the third became binding in 2018[5] 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-economic and biological variables of the fleets. These types of data are therefore comprehensive and provide 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 12).
- The last set of decisions, which serve as an information source for fishing fleet data in the context of GFCM fishery management plans, consists of Recommendation GFCM/43/2019/2 on a management plan for the sustainable exploitation of blackspot seabream in the Alboran Sea (geographical subareas 1 to 3); GFCM/43/2019/5 on a multiannual management plan for sustainable demersal fisheries in the Adriatic Sea (geographical subareas 17 and 18); 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; GFCM/41/2017/5 on the establishment of a regional adaptive management plan for the exploitation of red coral in the Mediterranean Sea; Recommendations 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 on small pelagic stocks in geographical subarea 18 (southern Adriatic Sea), and 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); 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); 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); and 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.

Finally, in addition to the GFCM decisions listed above, 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, and any other information submitted by countries to the GFCM.

[4] 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.

[5] Recommendation GFCM/41/2017/6 is the result of the progressive implementation of the Data Collection Reference Framework, and it repealed Recommendation GFCM/33/2009/3 (on the implementation of the GFCM Task 1 statistical matrix).

FISHING FLEET

The fishing fleets in operation in the Mediterranean (GSAs 1 to 27), Marmara Sea and the Black Sea (GSAs 28 and 29) consist of around 87 600 vessels, with a gross tonnage (GT) of around 903 000 tonnes and total engine power of 5 745 000 kW (Table 4). Despite the presence of some gaps, data coverage has generally improved over the last two years due to greater and more consistent data submissions from CPCs to the GFCM. This improvement in data transmissions is most likely responsible for the increase, by around 1 100 units, of operating vessels over the last two years (1.4 percent more than in *The State of Mediterranean and Black Sea Fisheries*) (FAO, 2018). Changes in the fleets per country show some variability,

TABLE 4. Number of operating fishing vessels by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor

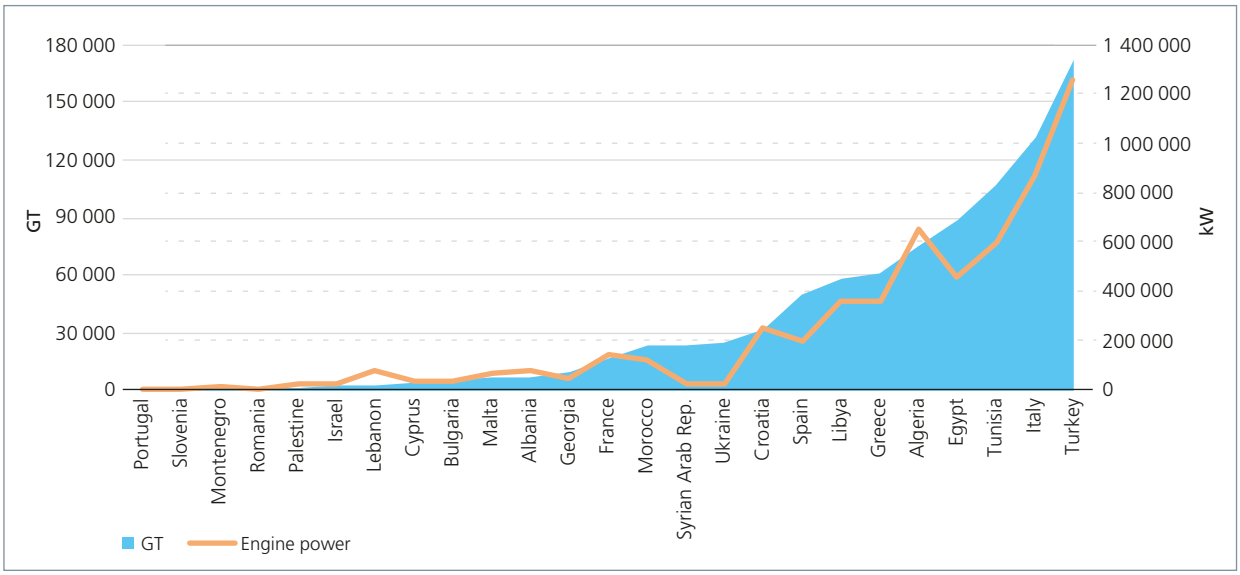
	Operating vessels		Capacity (GT)	Engine power (kW)	Reference year
	Number	Percentage of the total (%)			
Albania*	445	0.51	6 877	83 639	2019
Algeria*	5 608	6.40	74 654	654 955	2018
Bulgaria*	1 123	1.28	4 716	37 681	2019
Croatia*	6 211	7.09	32 113	251 922	2019
Cyprus*	774	0.88	3 440	36 305	2019
Egypt**	3 945	4.50	89 289	457 323	2018
France*	1 418	1.62	16 061	145 185	2019
Georgia*	49	0.06	9 184	43 264	2019
Greece*	12 807	14.61	60 808	356 528	2019
Israel*	336	0.38	2 039	24 282	2019
Italy*	10 909	12.45	132 483	863 979	2019
Lebanon*	2 084	2.38	2 045	77 547	2019
Libya**	3 974	4.53	58 366	359 925	2017
Malta*	682	0.78	6 530	73 272	2019
Montenegro*	224	0.26	862	9 777	2019
Morocco*	3 496	3.99	23 060	124 605	2019
Palestine*	613	0.70	1 826	23 121	2019
Portugal*	1	0.00	224	456	2019
Romania*	138	0.16	1 503	6 151	2019
Slovenia*	72	0.08	355	5 513	2019
Spain*	2 056	2.35	49 984	193 103	2019
Syrian Arab Republic*	1 300	1.48	23 400	26 000	2019
Tunisia*	13 300	15.18	106 700	600 250	2018
Turkey*	15 352	17.52	171 785	1 261 241	2018
Ukraine*	724	0.83	24 965	28 915	2019
Total	**87 641**	**100**	**903 270**	**5 744 940**	

Notes:
The following countries are not included in the table: Bosnia and Herzegovina, Japan and Monaco. These countries reported to the GFCM Secretariat that they had no operating fishing fleet at the time this publication was being prepared (Japan has 191 fishing vessels authorized to fish in the Mediterranean Sea). Additionally, the Russian Federation provided no data to the GFCM Secretariat on its fishing fleet as relating to the GFCM area of application.

Source of data:
* GFCM Data Collection Reference Framework (DCRF).

** The reported values for the Egyptian and Libyan fleets (capacity and engine power) are based on the most recent national data as officially transmitted by Egypt and Libya to the GFCM (via the DCRF and SAC national report) and then estimated on the basis of vessels in similar national fleets in the region.

FIGURE 2. Fishing capacity by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor



with six countries reporting an increase of over 15 percent each (Algeria, Egypt, Libya, Montenegro, Morocco and Ukraine) for a total of 5 109 vessels, while eight countries (Albania, Bulgaria, Greece, Israel, Malta, Portugal, Spain and Syrian Arab Republic) reported a decrease of over 13 percent each, dropping to 3 644 vessels in total. The overall number of vessels, as well as the (small) interannual variability, should still be considered as approximate and most likely as an underestimate of the real size of the fleet, given the lack of data, especially on small-scale fleets, from some Mediterranean and Black Sea coastal states or non-state actors.

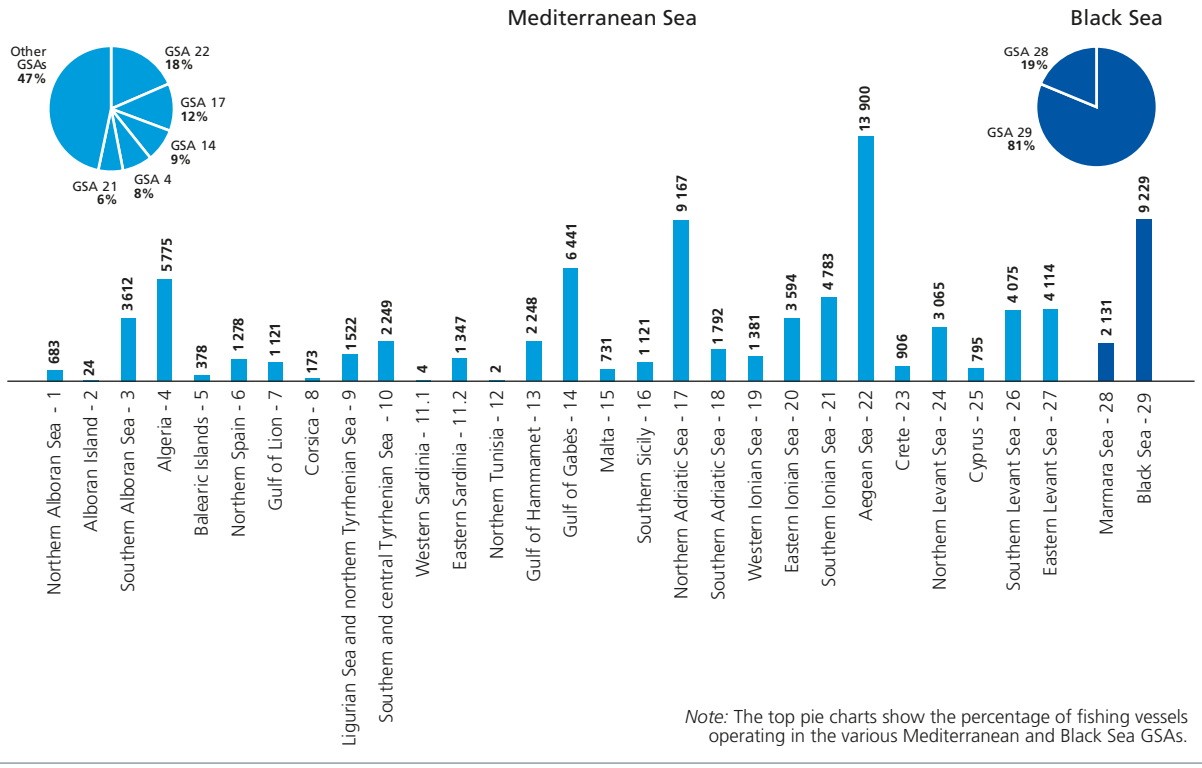
Around 60 percent of the total reported number is represented by just four countries: Turkey (17.5 percent), Tunisia (15.2 percent), Greece (14.6 percent) and Italy (12.4 percent). The breakdown by area revealed that, together, Tunisia, Greece and Italy account for around 48.5 percent of operating vessels in the Mediterranean Sea, while Turkey represents 82.1 percent of the total fleet in the Black Sea (Table 7).

FISHING CAPACITY

According to the most up-to-date information reported to the GFCM (Table 4), the capacity of operating fishing vessels in the Mediterranean and the Black Sea reaches about 903 000 GT and 5 745 000 kW, as shown in Figure 2. Compared to the capacity figures reported in *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018), more information is provided from Libya and Lebanon, which showed, respectively, a 66 percent increase and a 69 percent decrease in GT value, due to an improved analysis carried out on the latest data available. It is important to underline that five countries alone account for around 63 percent of the total fishing capacity (in GT) in the GFCM area of application: Turkey (19 percent), Italy (14.7 percent), Tunisia (11.8 percent), Egypt (9.9 percent) and Algeria (8.3 percent). Although Japan is also relevant in terms of capacity (around 77 000 GT), its fishing fleet is not currently operating in the area and therefore not considered in the analysis. Indeed, although 191 of its vessels are authorized to carry out fishing operations in the Mediterranean Sea, they are not fishing in this area. Other national fleets of substantial capacity (more than 49 000 GT) are from Greece, Libya and Spain.

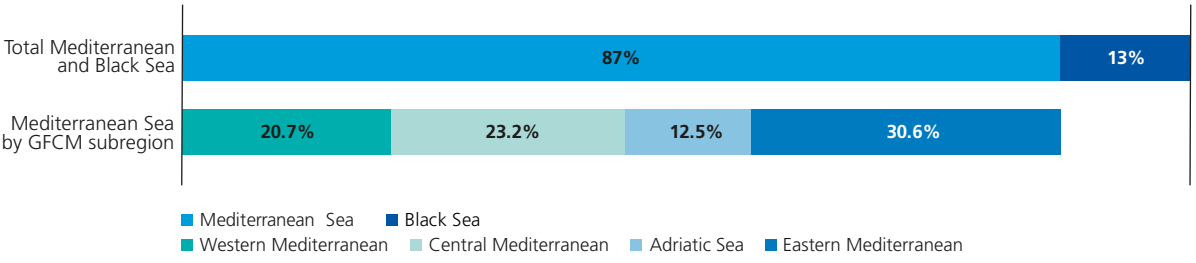
The distribution of the fishing fleet in the Mediterranean and the Black Sea is shown in Figure 3. The values displayed result from an analysis carried out on the latest available data (covering

FIGURE 3. Number of operating fishing vessels by geographical subarea



Note: The top pie charts show the percentage of fishing vessels operating in the various Mediterranean and Black Sea GSAs.

FIGURE4. Percentage of all fishing vessels operating in the Mediterranean and the Black Sea represented by each GFCM subregion



around 92 percent of the recorded fleet) as reported by countries to the GFCM through "DCRF Task II.1 Landing" (operating vessels and landings by fleet segment and GSA), which was then extrapolated to the total number of operating vessels (Table 4). The same method of analysis was used for all the tables and figures in this chapter.

In the Mediterranean Sea, five GSAs alone account for around 52 percent of all the operating fishing vessels: GSA 22 (Aegean Sea, 18.2 percent), GSA 17 (northern Adriatic Sea, 12 percent), GSA 14 (Gulf of Gabès, 8.4 percent), GSA 4 (Algeria, 7.6 percent) and GSA 21 (southern Ionian Sea, 6.3 percent).

In the Marmara Sea and Black Sea (GSAs 28 and 29), 81.2 percent of all operating fishing vessels are represented by GSA 29, with around 9 200 operating in this GSA.

The largest shares of operating vessels are from the eastern and central Mediterranean subregions, with 30.6 and 23.2 percent of the total respectively, whereas the Black Sea area (GSAs 28 and 29) accounts for 13 percent (Figure 4).

Box 2. Authorized fishing vessels in GFCM fisheries 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 notes provide the most up-to-date information on fishing vessels reported to the GFCM (topics are listed in alphabetical order and countries that submitted a list of authorized vessels are included in brackets):

Blackspot seabream fishery in the Alboran Sea (Morocco and Spain)
Recommendation GFCM/43/2019/2 on a management plan for the sustainable exploitation of blackspot seabream in the Alboran Sea (geographical subareas 1 to 3).

313 vessels are operating and authorized for the blackspot seabream fishery in geographical subareas (GSAs) 1 to 3. Morocco and Spain account for around 77 percent and 23 percent of the total fleet, respectively.

Demersal fisheries in the Adriatic Sea (Croatia and Slovenia)
Recommendation GFCM/43/2019/5 on a multiannual management plan for sustainable demersal fisheries in the Adriatic Sea (geographical subareas 17 and 18).

360 vessels (around 8 100 gross tonnage (GT)) are operating. Fishing vessels are bottom trawlers authorized for demersal fisheries in the Adriatic Sea (GSAs 17 and 18).

Demersal fisheries in the Strait of Sicily (Cyprus, Italy, Malta and Tunisia)
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.

1 095 vessels (around 83 000 GT) are operating. Fishing vessels are bottom trawlers authorized for demersal fisheries in the Strait of Sicily (GSAs 12 to 16). Italy and Tunisia account for around 59 percent and 39 percent of the total, respectively.

Demersal shrimp fisheries in the Strait of Sicily (Cyprus and Malta)
Recommendation GFCM/43/2019/6 on management measures for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp in the Strait of Sicily (geographical subareas 12, 13, 14, 15 and 16).

16 vessels are operating (around 2 125 GT). Fishing vessels are trawlers authorized for demersal fisheries in the Strait of Sicily (GSAs 12 to 16).

Red coral (Croatia, France, Italy, Tunisia and Spain)
Recommendation GFCM/43/2019/4 on a management plan for the sustainable exploitation of red coral in the Mediterranean Sea.

161 vessels (around 900 GT) are operating. Fishing vessels are those authorized to harvest red coral in the Mediterranean Sea. Croatia and Spain account for around 32 percent and 23 percent, respectively (i.e. 55 percent of the total fleet).

Small pelagic fisheries in the Adriatic Sea (Albania, Croatia, Italy, Montenegro and Slovenia)
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 of small pelagic stocks in geographical subarea 18 (southern Adriatic Sea).

558 vessels (around 32 000 GT) are operating. Fishing vessels are single and pair trawlers, purse seiners and those using surrounding nets without purse lines authorized to fish for small pelagic stocks and either registered at ports located in GSAs 17 and 18 or registered at ports located in other GSAs but operating in one or both of GSAs 17 and 18. Croatia and Italy account for around 61 percent and 26 percent of the fleet, respectively (i.e. 87 percent of the total fleet).

Trawl fishery in the Ionian Sea (Greece)
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).

115 vessels (around 12 500 GT) are operating. Fishing vessels are bottom trawlers authorized for demersal fisheries targeting giant red shrimp and blue and red shrimp in the Ionian Sea (GSAs 19 to 21).

Trawl fishery in the Levant Sea (Cyprus and Turkey)
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).

92 vessels (around 7 400 GT) are operating. Fishing vessels are bottom trawlers authorized for demersal fisheries targeting giant red shrimp and blue and red shrimp in the Levant Sea (GSAs 24 to 27).

Turbot fishery in the Black Sea (Bulgaria, Romania, Russian Federation and Turkey)
Recommendation GFCM/41/2017/4 on a multiannual management plan for turbot fisheries in the Black Sea (geographical subarea 29).

1 440 vessels (approximately 6 500 GT), with data coverage for fishing capacity reaching about 43 percent are operating. Fishing vessels are those using bottom-set gillnets and authorized to fish for turbot in GSA 29. Turkey accounts for around 86.4 percent of the total fleet.

In 2018, the ten ports with the greatest landings in the Mediterranean Sea (four Tunisian, three Moroccan, two Algerian and one Syrian) accounted for 7.3 percent of Mediterranean vessels, whereas in the Black Sea, the ten main ports (seven Bulgarian and three Turkish) represented 7.7 percent of the total fishing vessels in this basin (See Box 7).

The relevant groups of fishing vessels operating in the GFCM area of application are those authorized: a) within the context of nine GFCM fishery management plans, accounting for a total of 4 150 vessels (Box 2); and b) in two FRAs, representing a total of 164 vessels (Box 3).

AGE OF THE FISHING FLEET

The average construction year of the fishing vessels from each state or relevant non-state actor, as found in the GFCM vessel records (fleet register and authorized vessel list), is reported in Table 5. Although information on the year of construction is not always available for all countries (on average, the data covers around 71 percent of a country's total fleet), the following patterns emerge: Romania has the youngest fleet, with an average age of 13 years old, followed by Morocco (14 years old), Egypt (15 years old) and Algeria (20 years old). By contrast, the oldest fishing vessels are from Israel (46 years old), Slovenia (41 years old), Croatia (39 years old) and Albania (38 years old). While the ageing of the fleet in these latter countries may be a matter of concern for safety, the replacement of ageing vessels can present its own drawback. Potential increases in fishing capacity could ensue if no rules are in place to regulate the entry of new vessels into the fishery.

According to the available information, a comparison between the total number of fishing vessels in each country's fleet (Table 4) and the average age of its vessels shows that two of the smallest fleets in the GFCM area of application represent both the youngest (Romania, with an average age of 22 years old) and the oldest (Israel, with an average age of 46 years old) of the whole region.

A boxplot analysis revealed an asymmetric distribution of the average age of vessels among countries in both the Mediterranean and the Black Sea, with a higher variability of values (large interquartile range) in Albania, France, Israel, Italy, Malta, Montenegro and Spain (Figure 5).

A breakdown of the available information on the year of vessel construction identifies different patterns in the Mediterranean and the Black Sea (Figure 6). In particular, it is noteworthy that the Mediterranean Sea fleet is characterized by fishing vessels with an average age of 30 years old, with data coverage reaching about 76 percent, whereas the Black Sea has a younger fleet (24 years on average), with very low data coverage (only 26 percent).

Box 3. Authorized fishing vessels in GFCM fisheries restricted areas

In accordance with relevant GFCM recommendations, the 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 patterns and conservation of specific stocks (see Chapter 7 for further information). The following notes provide the most up-to-date information on fishing vessels reported to the GFCM.

Jabuka/Pomo Pit (Croatia and Italy)
Recommendation GFCM/41/2017/3 on the establishment of a fisheries restricted area in the Jabuka/Pomo Pit in the Adriatic Sea.

The Jabuka/Pomo Pit FRA in the Adriatic Sea was established to better protect vulnerable marine ecosystems and important essential fish habitats for demersal stocks such as the European hake (*Merluccius merluccius*) and Norway lobster (*Nephrops norvegicus*). It consists of one no-take zone and two zones where fishing is restricted to licensed vessels.

138 vessels are currently operating (63 Croatian and 75 Italian vessels) in the area where restricted fishing is allowed.

Gulf of Lion (France and Spain)
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.

The eastern Gulf of Lion FRA (2 018 km^2) in geographical subarea 7, where important spawning aggregations of various demersal species (European hake, monkfish, lobsters, etc.) occur, was established in 2009 to protect its deep-sea sensitive habitats.

26 vessels are operating in the FRA of the eastern Gulf of Lion. France accounts for around 76 percent of the total.

TABLE 5. Average year of construction and age of fishing vessels in the GFCM vessel record

CPCs and relevant non-state actors	Fishing vessels – Average		95% confidence interval	Data coverage (%)*
	Year of construction	Age		
Albania	1982	38	12–65	66.1
Algeria	2000	20	3–43	100.0
Bulgaria	1996	24	6–42	100.0
Croatia	1981	39	12–68	98.8
Cyprus	1991	29	12–46	100.0
Egypt	2005	15	2–31	65.8
France	1985	35	7–57	100.0
Georgia	1994	26	2–51	100.0
Greece	1987	33	9–59	100.0
Israel	1974	46	15–69	94.7
Italy	1985	35	7–64	100.0
Lebanon	N/A	–	–	–
Libya	1997	23	11–45	7.5
Malta	1989	31	8–60	99.9
Montenegro	1986	34	1–60	100.0
Morocco	2006	14	4–32	100.0
Palestine	N/A	–	–	–
Portugal	1993	27	20–32	100.0
Romania	2007	13	2–42	100.0
Slovenia	1979	41	15–66	100.0
Spain	1987	33	12–76	100.0
Syrian Arab Republic	N/A	–	–	–
Tunisia	1991	29	7–53	21.9
Turkey	1992	28	4–69	14.4
Ukraine	1991	29	7–54	84.0
Average	**1991**	**29**	**–**	**70.9**

Notes:
The following countries are not included in the table: Bosnia and Herzegovina, Japan and Monaco. These countries reported to the GFCM Secretariat that they had no operating fishing fleet at the time this publication was being prepared (Japan has 191 fishing vessels authorized to fish in the Mediterranean Sea). Additionally, the Russian Federation provided no data to the GFCM Secretariat on its fishing fleet as relating to the GFCM area of application.

*Coverage indicates the percentage of data records with information on the construction year of the fishing vessel.

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

FIGURE 5. Average age of fishing vessels by GFCM contracting party, cooperating non-contracting party and non-contracting party

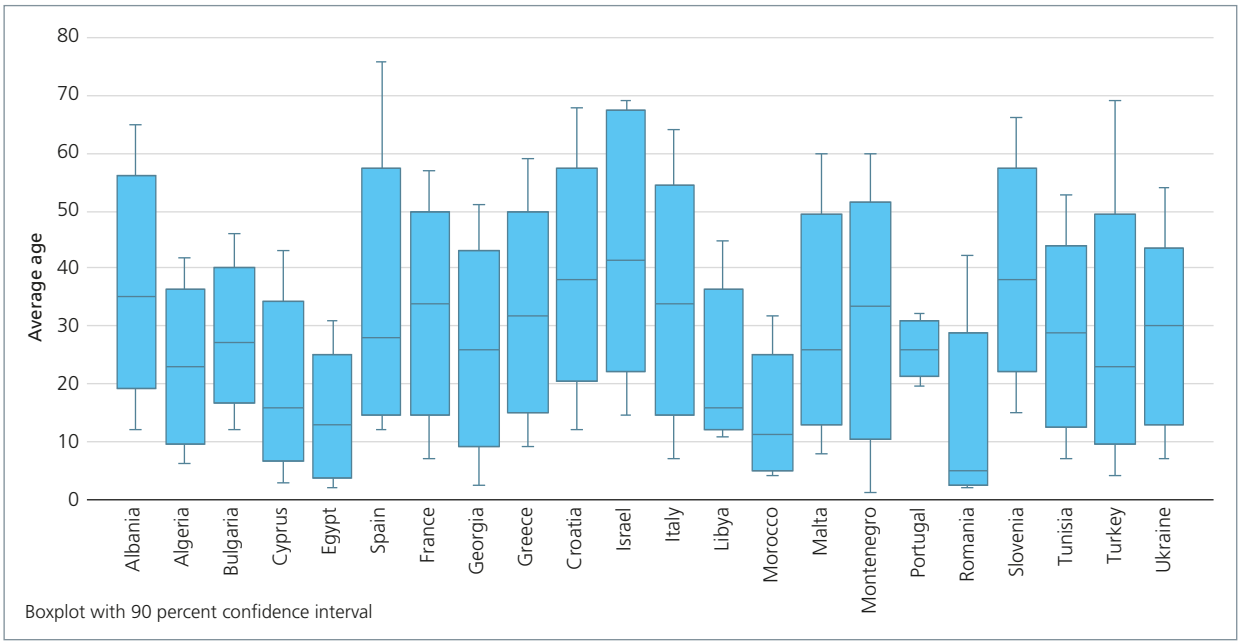
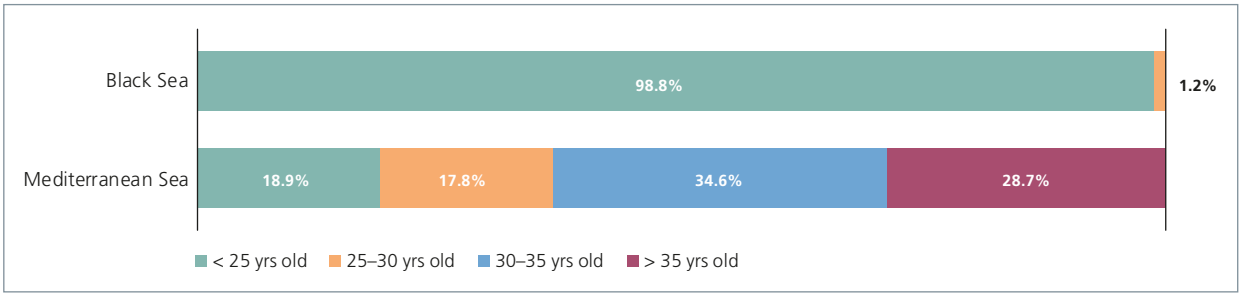


FIGURE 6. Age composition of the fishing fleet in the Mediterranean and the Black Sea



FISHING FLEET SEGMENTS

The analysis of the fishing fleet segments (Box 4) operating in the Mediterranean and the Black Sea over the period 2018–2019 is based on a total number of 53 fleet segments – defined as the intersections between all predefined vessel groups and all length classes (Box 5). As with the results reported in *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018), this analysis revealed a heterogeneous approach to data collection among countries: indeed, several CPCs have aggregated their data and then communicated them to the GFCM by combining the same vessel groups with different length classes. Subsequently, the length ranges of some fleets segments overlap (e.g. "Trawlers between 12–24 m" with "Trawlers above 6 m").

To facilitate the analysis presented in *The State of Mediterranean and Black Sea Fisheries 2020*, the 53 fleet segments by which CPCs report data have been sorted into four fleet segment groups, as outlined in Table 6. While these groups remain largely the same as those reported in previous versions of *The State of Mediterranean and Black Sea Fisheries*, an important difference is found in the name of the "Small-scale vessels" group, which was previously called "Polyvalent vessels (all lengths)". This change was made to reflect the conclusions of the second meeting of the Working Group on Small-Scale Fisheries (WGSSF) which noted that, in the absence of a definition of small-scale fisheries (SSF), experts advocated to "continue including polyvalent vessels of less than 12 m length overall (LOA) as SSF vessels

for data reporting purposes, while polyvalent vessels larger than 12 m should not be included in the SSF group for data analysis" (GFCM, 2019b). As a result, the "Polyvalent vessels" fleet segments (>0 m, >6 m, >12 m, >24 m, 0–24 m, 6–24 m, 12–24 m), previously reported under the umbrella group "Polyvalent vessels (all lengths)", are now reported under the group "Other fleet segments". Similarly, in line with the discussions of the WGSSF, longliners below 12 m LOA are included within the "Small-scale vessels" group.

Although this heterogeneity prevents an in-depth comparison of all fleet segments at the national level, the data[6] show that around 83 percent of the total fishing vessels operating in the GFCM area of application (Mediterranean and Black Sea) belong to the

[6] Information on fleet segments for Bosnia and Herzegovina, Georgia, Russian Federation and Syrian Arab Republic are not available and thus not included in this analysis.

Box 4. Definition of GFCM fleet segments

Recommendation GFCM/41/2017/6 on the submission of data on fishing activities in the GFCM area of application defines the concept of flexibility of fishing fleet segments for data reporting purposes by contracting parties and cooperating non-contracting parties (CPCs) to the GFCM. Following the specific guidance offered by the Data Collection Reference Framework (DCRF) manual, CPCs are encouraged to define fleet segments as the intersections between all the predefined vessel groups and all length classes. Any proposal for the 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 should, in turn, 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 engines using passive gear	P-01	P-02	P-03	P-04
			P-13			
		Small-scale vessels with engines 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 engines smaller than 6 m and between 6–12 m).
- A vessel is assigned to a group on the basis of the dominant gear, used the greatest percentage of time: (i.e. more than 50 percent of the time at sea using the same fishing gear during the year).
- "Polyvalent vessels" are defined as all vessels using more than one gear type, with a combination of passive and active types of gear, none of which are used for more than 50 percent of the time at sea during the year.
- A vessel is considered "active" if it executes at least one fishing operation during the course of the reference year in the GFCM area of application.

group "Small-scale vessels", after which follow "Trawlers and beam trawlers" (7.8 percent), "Purse seiners and pelagic trawlers" (5.1 percent) and finally "Other fleet segments" (4.2 percent) (Figure 7).

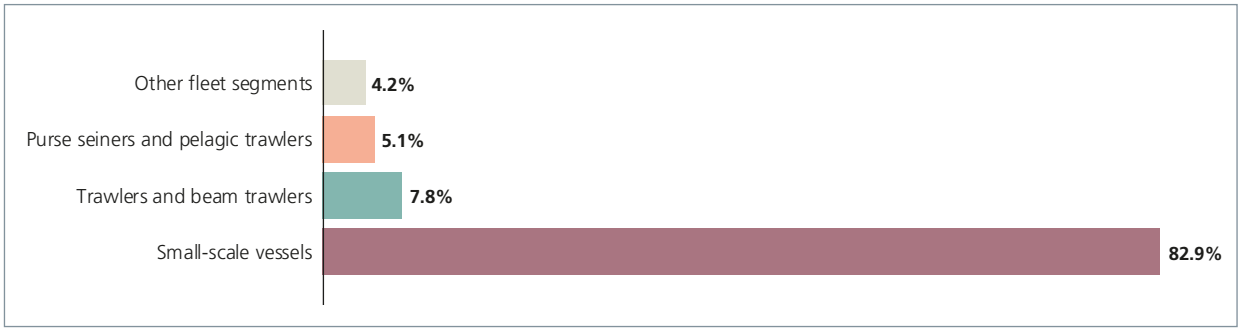
The fleet segment groups "Small-scale vessels" and "Trawlers and beam trawlers" are the main categories in the Mediterranean and the Black Sea. The prevalence of the "Small-scale vessels" group is only slightly higher in the Black Sea (88.2 percent) compared to the Mediterranean (82.1 percent), while similarly, the fleet segment group "Trawlers and beam trawlers" plays approximately the same importance in the two areas (7.4 percent in the Black Sea versus 7.9 percent in the Mediterranean Sea) (Figure 8).

Based on the available information, the "Small-scale vessels" group represents more than 90 percent of the operating fishing fleet in eight countries – six in the Mediterranean Sea

TABLE 6. Grouping of fleet segments in the fleet composition

Fleet segment group	Fleet segments
Small-scale vessels	• Small-scale vessels without engines using passive gear (all) • Small-scale vessels with engines using passive gear (all) • Polyvalent vessels (0–6 m, 0–12 m, 6–12 m) • Longliners (0–6 m, 0–12 m, 6–12 m)
Trawlers and beam trawlers	• Trawlers (all) • Beam trawlers (all)
Purse seiners and pelagic trawlers	• Purse seiners (all) • Pelagic trawlers (all)
Other fleet segments	• Longliners (>12 m) • Tuna seiners (all) • Dredgers (all) • Polyvalent (> 0 m, > 6 m, 0–24 m, 6–24 m, > 12 m, 12–24 m, > 24 m)

FIGURE 7. Fleet segment composition in the GFCM area of application



Box 5. Composition of the main groups of GFCM fleet segments

Inside each of the main fleet segment groups, analysis revealed the following detailed partitioning:

- Small-scale vessels
  - "Small-scale vessels with engines using passive gear 6–12 m" (19.5 percent)
  - "Small-scale vessels with engines using passive gear 0–6 m" (17.9 percent)
  - "Polyvalent vessels 6–12 m" (15.5 percent)
  - "Small-scale vessels without engines using passive gear 0–12 m" (8.2 percent)
- Trawlers and beam trawlers
  - "Trawlers 12–24 m" (4.3 percent)
  - "Trawlers > 6 m" (1.8 percent)
  - "Trawlers > 24 m" (0.8 percent)
  - "Trawlers 6–24 m" (0.5 percent)
- Purse seiners and pelagic trawlers
  - "Purse seiners 6–12" (1.4 percent)
  - "Purse seiners > 12 m" (1.4 percent)
  - "Purse seiners 12–24 m" (1.3 percent)
  - "Purse seiners > 6 m" (0.5 percent)
- Other fleet segments
  - "Polyvalent vessels 12–24 m" (1.6 percent)
  - "Longliners 12–24 m" (1.4 percent)
  - "Dredgers 12–24 m" (0.8 percent)
  - "Longliners > 6 m" (0.4 percent)

The most common fleet segment group is "Small-scale vessels with engines using passive gear" (48.4 percent), though "Small-scale vessels without engines" is also quite relevant, representing 9.6 percent of vessels in the whole region.

TABLE 7. Number of operating fishing vessels by fleet segment group and by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor

Country	Group of fleet segments					Total
	Small-scale vessels	Trawlers and beam trawlers	Purse seiners and pelagic trawlers	Other fleet segments	Unallocated	
Mediterranean Sea						
Albania*	298	120	23	4		**445**
Algeria*	3 464	553	1 591	0		**5 608**
Croatia*	5 666	341	170	34		**6 211**
Cyprus*	731	8	0	35		**774**
Egypt**	1 759	945	211	1 030		**3 945**
France*	1 261	85	16	56		**1 418**
Greece*	12 215	226	218	148		**12 807**
Israel*	268	19	10	39		**336**
Italy*	7 603	2 024	451	831		**10 909**
Lebanon*	1 979	0	91	14		**2 084**
Libya**	2 914	80	123	709	147	**3 974**
Malta*	529	20	4	129		**682**
Montenegro*	191	13	20	0		**224**
Morocco*	3 042	149	244	61		**3 496**
Palestine*	404	12	197	0		**613**
Portugal*	0	0	0	1		**1**
Slovenia*	63	9	0	0		**72**
Spain*	1 053	576	219	208		**2 056**
Syrian Arab Republic*					1 300	**1 300**
Tunisia*	12 328	479	448	45		**13 300**
Turkey*	5 656	226	58	85		**6 026**
Total	**61 425**	**5 884**	**4 096**	**3 429**	**1 447**	**76 281**
%	**80.5**	**7.7**	**5.4**	**4.5**	**1.9**	
Black Sea						
Bulgaria*	1 036	12	45	30		**1 123**
Georgia*					49	**49**
Romania*	72	30	11	25		**138**
Turkey*	8 157	792	219	158		**9 326**
Ukraine*	716	4	0	4		**724**
Total	**9 981**	**838**	**275**	**218**	**49**	**11 360**
%	**87.9**	**7.4**	**2.4**	**1.9**	**0.4**	

Notes:
The following countries are not included in the table: Bosnia and Herzegovina, Japan and Monaco. These countries reported to the GFCM Secretariat that they had no operating fishing fleet at the time this publication was being prepared (Japan has 191 fishing vessels authorized to fish in the Mediterranean Sea). Additionally, the Russian Federation provided no data to the GFCM Secretariat on its fishing fleet as relating to the GFCM area of application.
Source of data:
* GFCM DCRF.
**GFCM DCRF and GFCM vessel records (fleet register and authorized vessel list).

FIGURE 8. Fleet segment composition in the Mediterranean and the Black Sea

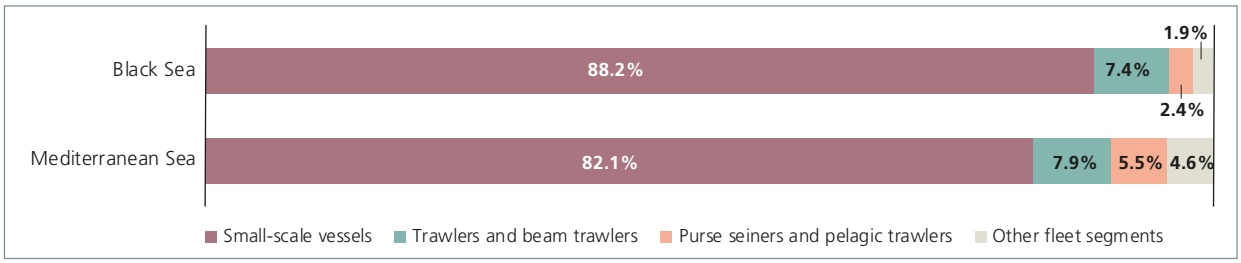


FIGURE 9. Number of operating fishing vessels by fleet segment group and GFCM subregion

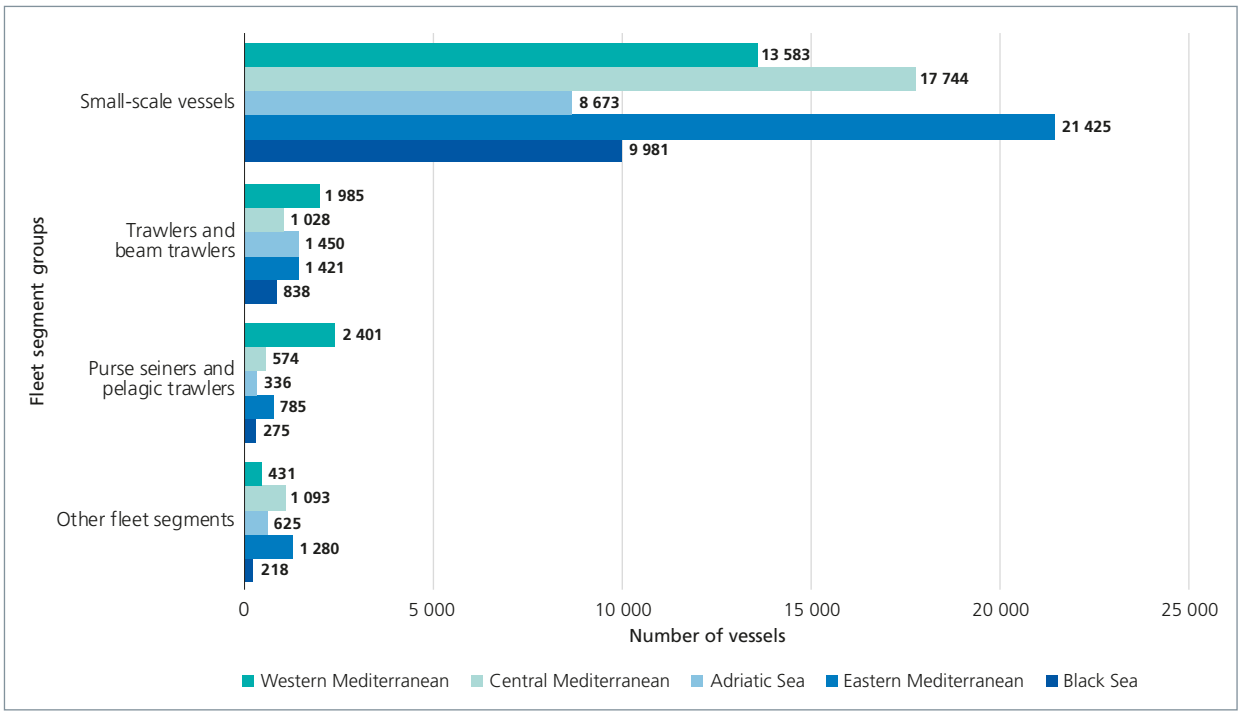


TABLE 8. Percentage of the subregional total fishing fleets represented by each fleet segment group

Fleet segment groups	Mediterranean Sea				Black Sea (%)
	Western Mediterranean (%)	Central Mediterranean (%)	Adriatic Sea (%)	Eastern Mediterranean (%)	
Small-scale vessels	73.8	86.8	78.2	86.0	88.2
Trawlers and beam trawlers	10.8	5.0	13.1	5.7	7.4
Purse seiners and pelagic trawlers	13.1	2.8	3.0	3.2	2.4
Other fleet segments	2.3	5.3	5.6	5.1	1.9
	100	**99**	**100**	**100**	**100**

(Croatia, Cyprus, Greece, Lebanon, Tunisia and Turkey) and two in the Black Sea (Bulgaria and Ukraine).

Without considering the unallocated fishing vessels, the "Small-scale vessels" group ranges from constituting 73.8 percent of the fleet in the western Mediterranean to 85.8 percent in the central Mediterranean; the "Trawlers and beam trawlers" group stretches from 5 percent in the central Mediterranean to 13.1 percent in the Adriatic Sea; whereas the "Purse seiners and pelagic trawlers" group runs from 2.8 percent in the central Mediterranean to 13.1 percent in the western Mediterranean (Table 8).

The subregional distribution of the main fleet segment groups is illustrated in Figure 9. As shown, the "Small-scale vessels" group is mainly present in the eastern Mediterranean (21 425 vessels, 30 percent of the total) and in the central Mediterranean (17 744 vessels, 24.9 percent of the total).

In contrast, the western Mediterranean (1 985 vessels, 29.5 percent of the total), the Adriatic Sea (1 450 vessels, 21.1 percent of the total) and the eastern Mediterranean (1 421 vessels, 21.1 percent of the total) represent the main subregions in terms of the "Trawlers and beam trawlers" group.

Finally, "Purse seiners and pelagic trawlers" show the most imbalanced geographical distribution, with the western Mediterranean accounting for 54.9 percent of the total fleet (2 401 vessels).

2. Capture fisheries production

This chapter summarizes relevant information on capture fisheries production (expressed in tonnes) in the GFCM area of application. Historical trends of catch in the Mediterranean Sea (geographical subareas (GSAs) 1 to 27) and the Black Sea[4] (GSAs 28 and 29) are here reported at the regional, subregional and national levels, together with a summary of the main species and groups of species contributing to the catch at the various spatial scales analysed, taking into account the most up-to-date information, including 2018 data on landings.

The analysis is based on information from two different sources that feed into the existing GFCM regional databases on capture production. The first one consists of the data on annual catch by species and FAO subdivision that are reported by Mediterranean and Black Sea countries through the FAO/GFCM STATLANT 37A questionnaire to FAO and the GFCM. The STATLANT questionnaire was developed by the FAO Coordinating Working Party on Fishery Statistics and is annually sent by the Organization on behalf of the GFCM to relevant national authorities; it covers the time series from 1970 to

[4] FAO Subarea 37.4 (Black Sea) includes the Marmara Sea (GSA 28), the Black Sea (GSA 29) and the Azov Sea (GSA 30), while in this issue of *The State of Mediterranean and Black Sea Fisheries*, the Black Sea subregion encompasses the Marmara Sea and the Black Sea (GSAs 28 and 29) but excludes the Azov Sea (GSA 30).

Box 6. Estimation of capture fisheries production in FAO/GFCM STATLANT 37A

National catch figures annually reported by countries through the STATLANT 37A questionnaire are compared with the data collected by FAO at the "major fishing area" level, without a breakdown of catch by species or by statistical subdivision. At the end of this process, missing values must be estimated in order to ensure coherence with the FAO Global Capture Production Database, at least for FAO International Standard Statistical Classification for Aquatic Animals and Plants (ISSCAAP) groups of species. The following ISSCAAP groups have been excluded in the analysis of catch carried out in this report:

- Carp, barbel and other cyprinids
- Miscellaneous freshwater fish
- Tuna, bonito, billfish
- Freshwater crustaceans
- Brown seaweeds
- Red seaweeds
- Miscellaneous aquatic plants

2018 (the method used to estimate capture production from this source is explained in Box 6). The second source of information is the national data officially submitted to the GFCM by its contracting parties and cooperating non-contracting parties (CPCs) in line with binding GFCM recommendations, mainly through the Data Collection Reference Framework (DCRF); these data cover the 2014–2018 time series.

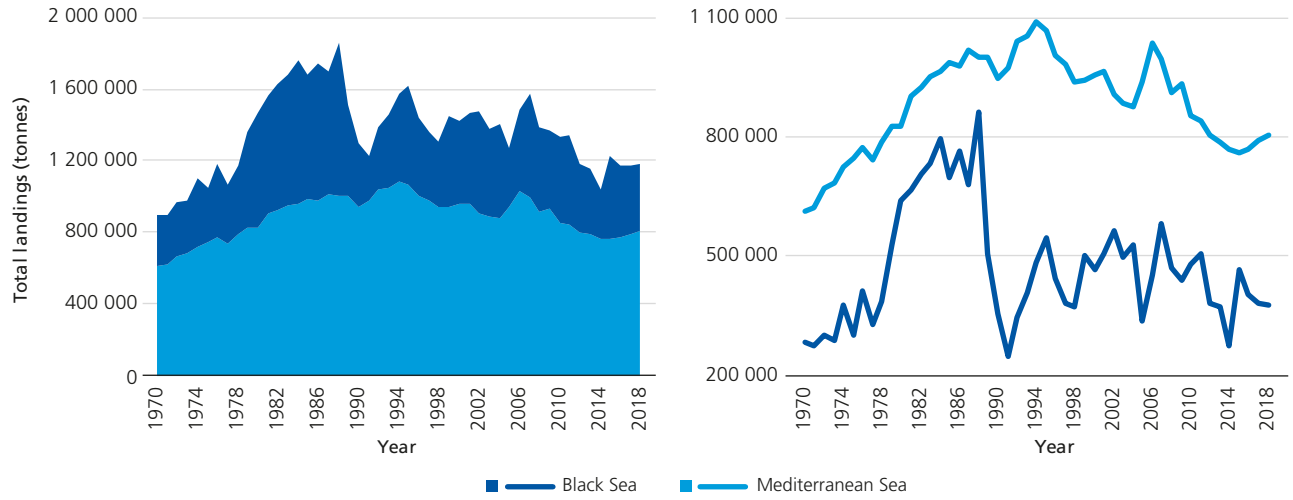
The tables and figures in this chapter are all based on the existing FAO and GFCM data on capture production. In comparison with the previous editions of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2016, 2018), the analysis presented in this chapter has completely excluded the catch of tunas and tuna-like species (group 36 "tunas, bonitos, billfishes" of the FAO International Standard Statistical Classification for Aquatic Animals and Plants), whose fisheries are under the management of the International Commission for the Conservation of Atlantic Tunas. When comparing current data with data from earlier issues of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2016, 2018), this change has been corrected for by eliminating that group from previous estimates.

HISTORICAL TRENDS AND CURRENT CAPTURE FISHERIES PRODUCTION

Overall, total capture fisheries production in the Mediterranean and the Black Sea increased irregularly from about one million tonnes in 1970 to almost 1 788 000 tonnes in 1988. Total landings remained relatively stable during most of the 1980s, before declining abruptly in 1990 and 1991, largely due to the collapse of pelagic fisheries in the Black Sea. In the Mediterranean Sea, landings continued to increase until 1994, reaching 1 087 000 tonnes, and subsequently declined irregularly to 760 000 in 2015, with production increasing over the following three years and reaching 805 700 tonnes in 2018. In the Black Sea, landings have varied considerably from one year to another since 1990, showing a generally increasing trend between 1992 and 1995, followed by a decreasing trend in the period 1996–1998, then fluctuations until 2018, when the total reported landings in the Black Sea were 324 100 tonnes (Figure 10).

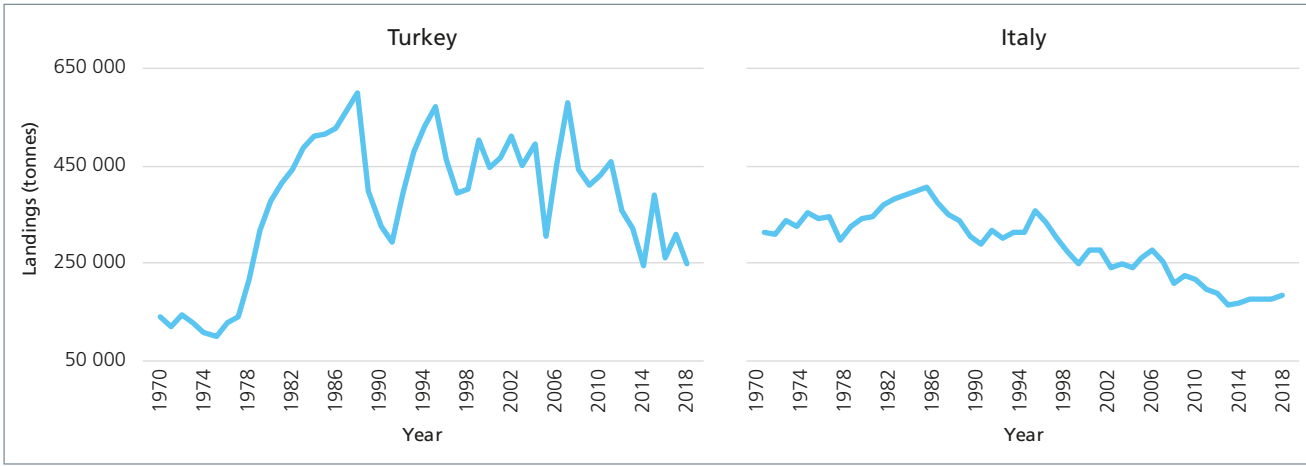
The combined average landings for the Mediterranean and the Black Sea over the 2016–2018 period amount to 1 175 700 tonnes (787 900 tonnes in the Mediterranean, accounting for 67 percent of the total, and 387 800 tonnes in the Black Sea). This value is slightly higher (2.7 percent) than the catch from the 2014–2016 period, with an increase of 2.9 percent in the Mediterranean Sea and 2.1 percent in the Black Sea. The landings time series (1970–2018) of the largest producers, as well as of countries catching up to 150 000 tonnes and of countries catching up

FIGURE 10. Total landings in the Mediterranean and the Black Sea per year, 1970–2018



Note: Left panel: cumulative trends from the Mediterranean and the Black Sea; right panel: trends by basin (Mediterranean and Black Sea).

FIGURE 11. Total landings of the two largest producers (Turkey and Italy) per year, 1970–2018



to 20 000 tonnes, are reproduced in Figure 11 and Figure 12 for reference.

In the GFCM area of application, Turkey is the main producer (274 000 tonnes, 23.3 percent of the total), followed by Italy (178 000 tonnes, 15.2 percent) and Algeria (103 000 tonnes, 8.8 percent), which has grown to be the third largest producer from being the fourth in the period 2014–2016. Other countries that contribute at least 5 percent of the total catch are Tunisia (96 300 tonnes, 8.2 percent), Spain (78 500 tonnes, 6.7 percent), Greece (73 000 tonnes, 6.2 percent), Georgia (70 800 tonnes, 6 percent), Croatia (70 000 tonnes, 6 percent) and the Russian Federation (70 000 tonnes, 6 percent) (Figure 14).

In the Mediterranean Sea, Italy continues to be the main producer (22.7 percent), followed by Algeria (13.1 percent), Tunisia (12.2 percent), Spain (10 percent), Greece (9.3 percent), Croatia (8.9 percent), Egypt (6.9 percent), and then Turkey (6.4 percent) (Figure 11, Figure 12 and Figure 15). The highest percentage increase in the Mediterranean Sea is shown by Turkey (50 770 tonnes, + 20.4 percent); by contrast, the greatest decrease is represented by Morocco (23 200 tonnes, - 10.6 percent) (Figure 16).

In addition to the CPCs described above, others that have shifted in the rankings from *The State of Mediterranean and Black Sea Fisheries 2018* (FAO, 2018) include Spain (78 500 tonnes and 6.5 percent), which increased its contribution to

FIGURE 12. Total landings per year by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor catching up to 150 000 tonnes, 1970–2018

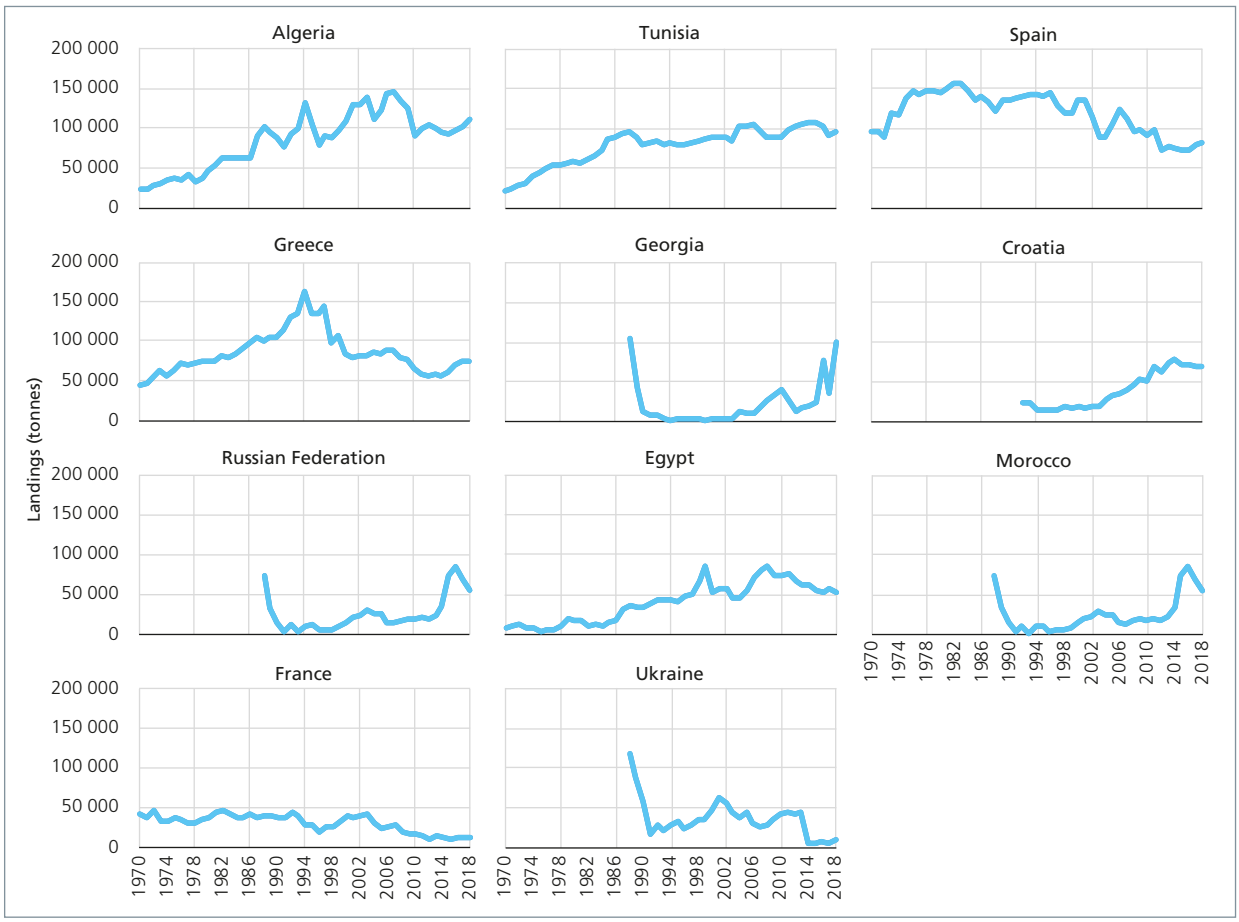
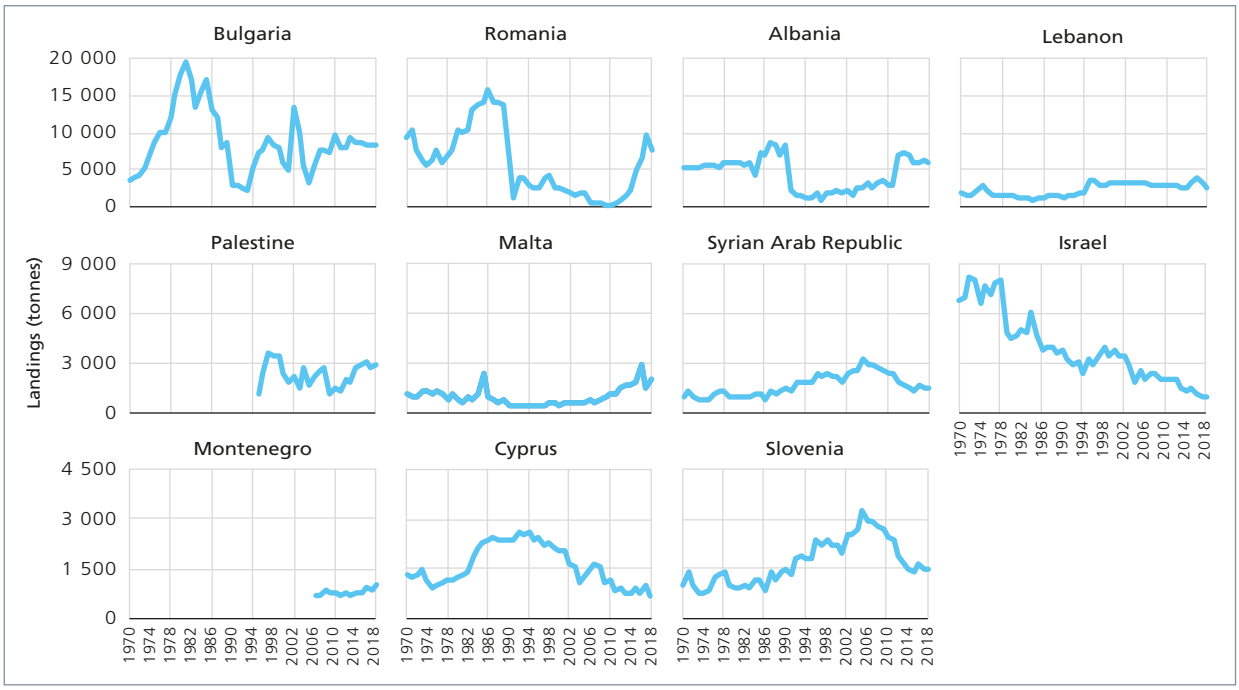


FIGURE 13. Total landings per year by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor catching up to 20 000 tonnes, 1970–2018



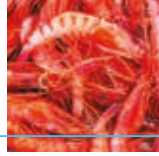


TABLE 9. Total landings per year by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor, 2016–2018

CPCs and relevant non-state actors	Total landings (tonnes)			Average	Variation %	Variation %
	2016	2017	2018	2016–2018	2016–2017	2017–2018
Albania	6 105	6 432	6 113	**6 217**	5.36	-4.96
Algeria	96 667	101 123	111 232	**103 008**	4.61	10.00
Bosnia and Herzegovina	5	5	5	**5**	0.00	0.00
Bulgaria	8 494	8 494	8 522	**8 503**	0.00	0.33
Croatia	72 251	68 844	69 141	**70 079**	-4.72	0.43
Cyprus	792	995	654	**813**	25.71	-34.31
Egypt	51 977	57 003	54 097	**54 359**	9.67	-5.10
France	11 025	11 092	12 504	**11 540**	0.60	12.73
Georgia*	77 293	35 503	99 812	**70 869**	-54.07	181.14
Greece	70 747	74 402	73 688	**72 946**	5.17	-0.96
Israel	1 120	985	985	**1 030**	-12.05	0.00
Italy	177 699	175 366	183 104	**178 723**	-1.31	4.41
Lebanon	3 932	3 376	2 534	**3 281**	-14.14	-24.94
Libya	27 934	30 209	30 219	**29 454**	8.14	0.03
Malta	2 865	1 552	1 986	**2 134**	-45.83	27.96
Monaco	1	1	1	–	–	–
Montenegro	925	827	1 015	**922**	-10.59	22.73
Morocco	21 957	23 575	23 997	**23 176**	7.37	1.79
Palestine	3 091	2 784	3 000	**2 958**	-9.93	7.76
Portugal	115	58	52	**75**	-49.39	-10.15
Romania	6 840	9 553	7 745	**8 046**	39.66	-18.93
Russian Federation**	85 976	69 378	54 664	**70 006**	-19.31	-21.21
Slovenia	166	138	134	**146**	-16.56	-3.19
Spain	73 372	79 949	82 055	**78 458**	8.96	2.64
Syrian Arab Republic	1 632	1 508	1 508	**1 549**	-7.60	0.00
Tunisia	101 467	91 010	96 298	**96 259**	-10.31	5.81
Turkey	259 987	311 641	250 302	**273 977**	19.87	-19.68
Ukraine	7 084	5 426	9 133	**7 214**	-23.40	68.33

Notes:
* Landings statistics from Georgia relating to the period from 2016 onwards have been reviewed on the basis of work carried out under the umbrella of the Working Group on the Black Sea (WGBS). Variations in landings between years are mostly due to fluctuations in the reported catch of European anchovy.
** Information provided by the Russian Federation. Includes statistical data for the Autonomous Republic of Crimea and the city of Sevastopol, Ukraine, temporarily occupied by the Russian Federation.

FIGURE 14. Average annual landings of GFCM contracting parties, cooperating non-contracting parties, non-contracting parties and relevant non-state actors contributing at least 5 percent of the total catch in the GFCM area of application, 2016–2018

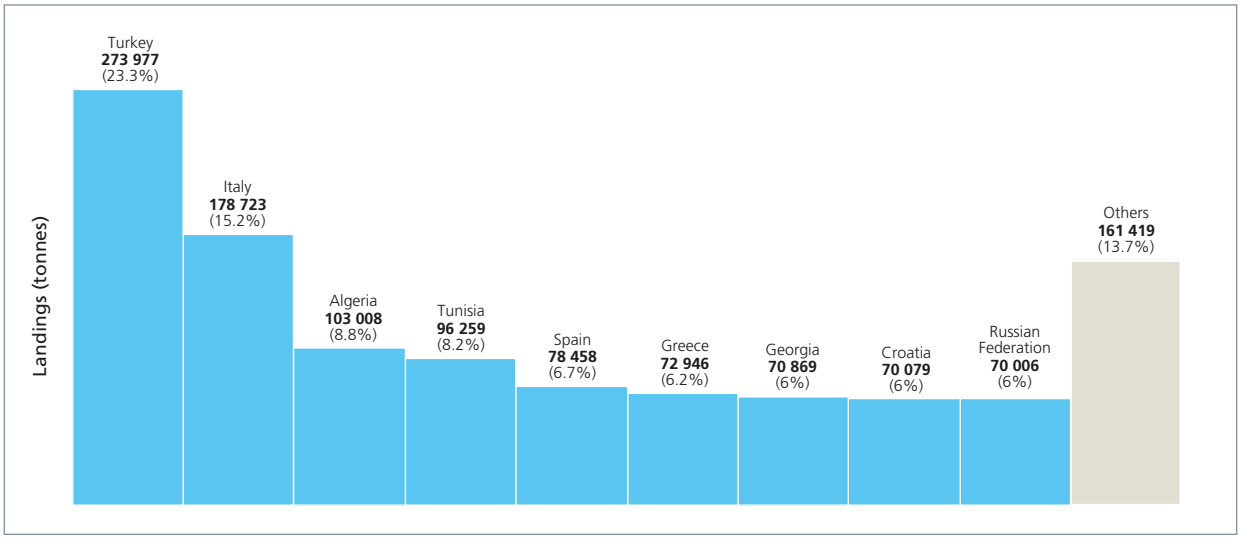
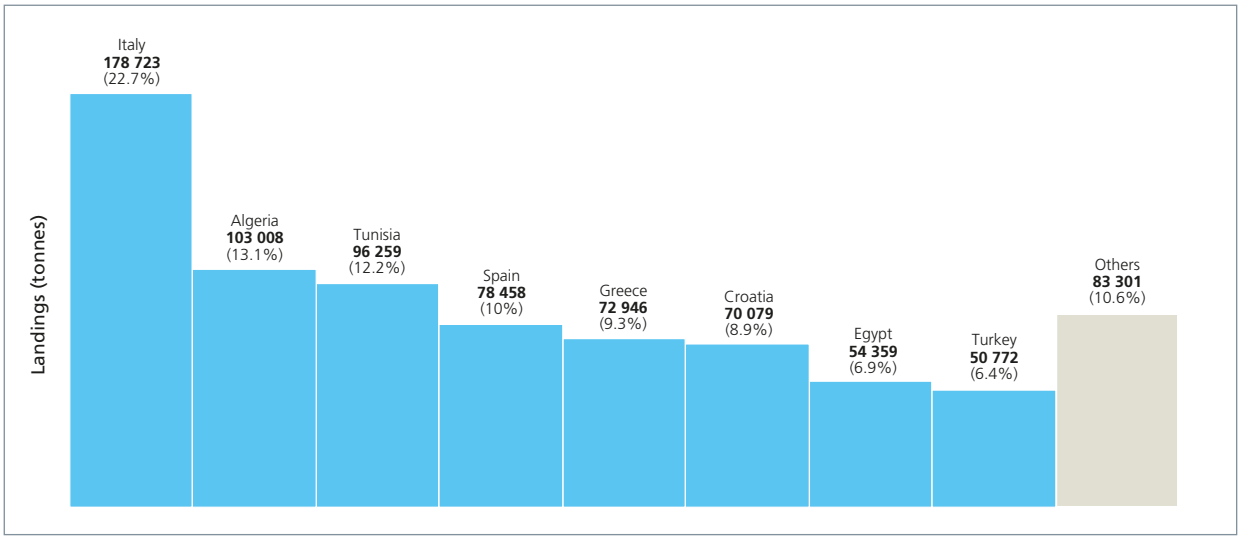


FIGURE 15. Average annual landings of GFCM contracting parties, cooperating non-contracting parties, non-contracting parties and relevant non-state actors contributing at least 5 percent of the total catch in the Mediterranean Sea, 2016–2018



Mediterranean landings by 7.8 percent compared to the period 2014–2016, now becoming the fifth largest producer in the GFCM area of application and the fourth in the Mediterranean Sea. In contrast, Croatia's landings decreased by around 6.4 percent (70 000 tonnes) and the country now ranks as the eighth largest producer (it was the fifth in the period 2014–2016) (Figure 16).

In the Black Sea, Turkey dominates the catch (57.6 percent), although it accounts for a lower percentage compared to the period 2014–2016, when it brought in 67.6 percent. The other countries are Georgia (18.3 percent), the Russian Federation (18.1 percent), Bulgaria (2.2 percent), Romania (2.1 percent) and Ukraine (1.9 percent) (Figure 17). The most evident increase compared to the period 2014–2016 is shown by Georgia (accounting for 70 900 tonnes in 2018, + 78.9 percent), whose landing statistics largely depend on the fluctuating catch of anchovy and have been subject to an important review within the work carried out under the umbrella of the WGBS.

FIGURE 16. Percentage variation between total landings recorded over 2014–2016 and total landings recorded over 2016–2018 by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor

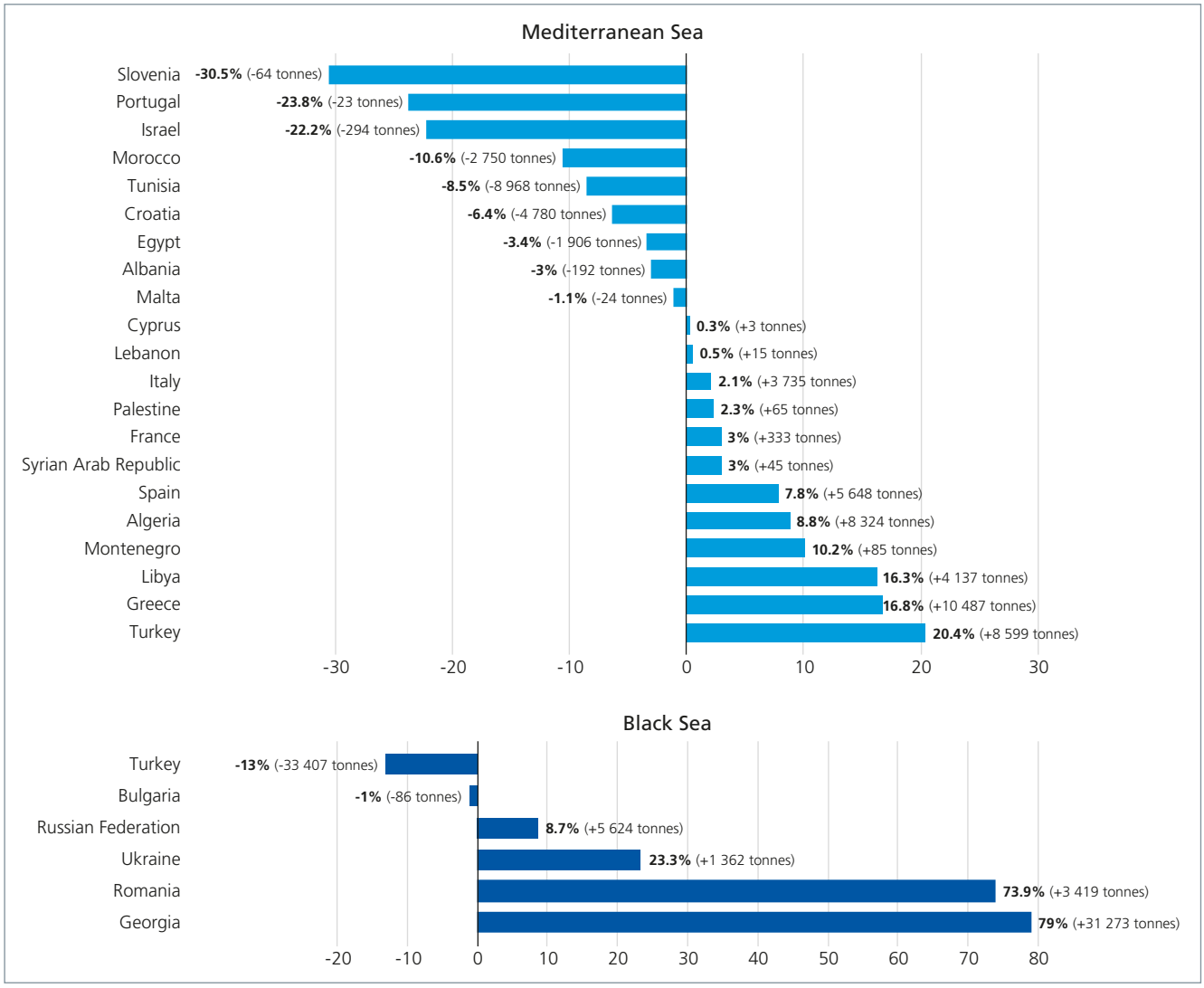


FIGURE 17. Average annual total catch by GFCM contracting party, cooperating non-contracting party and non-contracting party in the Black Sea, 2016–2018

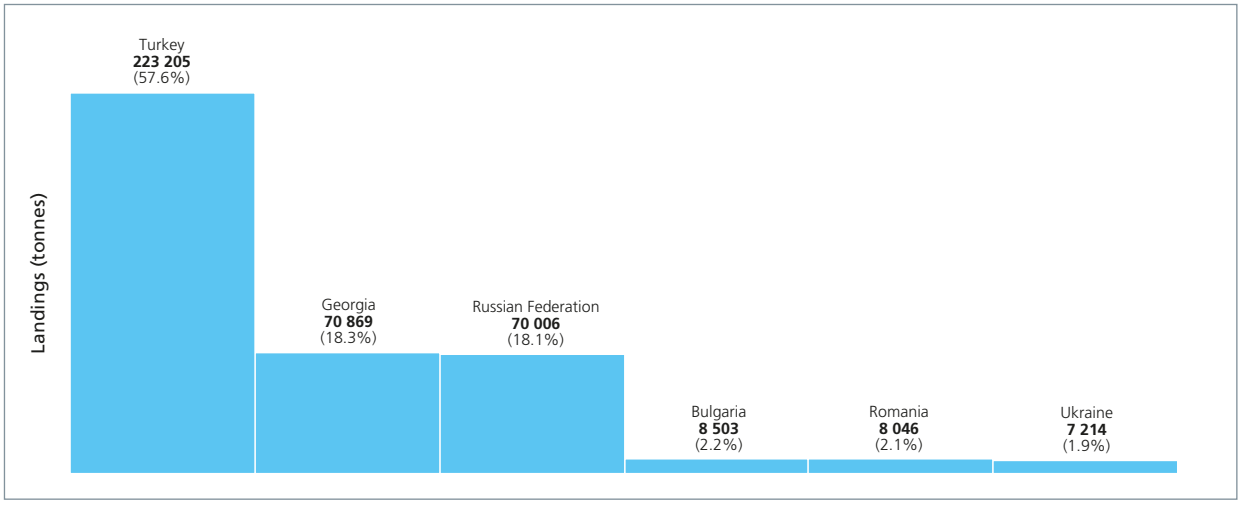
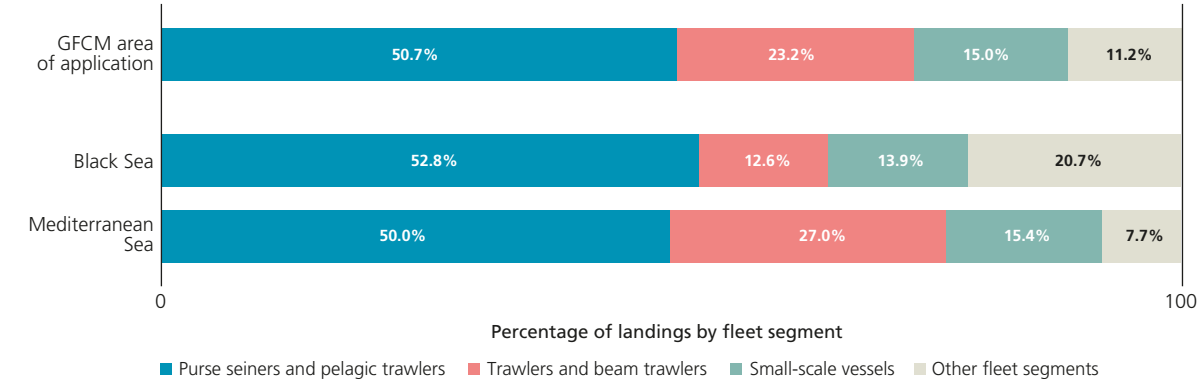


FIGURE 18. Total landings by fleet segment in the GFCM area of application, the Mediterranean and the Black Sea, 2016–2018



Romania also has shown an important increase in landings (+ 73.9 percent) followed by Ukraine (+ 23.3 percent). Bulgarian catch remains quite constant, whereas Turkey has decreased its contribution to Black Sea landings by around 13 percent (see Table 9, Figure 12 and Figure 16).

Taking into account the contribution of each fleet component to the average 2016–2018 landings data, as transmitted by CPCs through the DCRF Task II.1 "Landings," and classifying the fleet segments as defined in Chapter 1, the group "Purse seiners and pelagic trawlers" continues to be the segment responsible for the largest share of total landings (50.7 percent), with similar percentages in the Mediterranean Sea (50 percent) and the Black Sea (52.8 percent) (Figure 18). "Trawlers and beam trawlers" is the second largest fleet segment group (23.2 percent) in terms of its contribution to the landings, with a higher importance in the Mediterranean Sea (27 percent) than in the Black Sea (12.6 percentage). The group "Small-scale vessels" has a similar impact in both the Mediterranean (15.4 percent) and the Black Sea (13.9 percent). Finally, the miscellaneous group "Other fleet segments" accounts for 11.2 percent of the total, with a higher impact on landings in the Black Sea (20.7 percent) than in the Mediterranean (7.7 percent).

MAIN SPECIES AND GROUPS CONTRIBUTING TO CAPTURE FISHERIES PRODUCTION

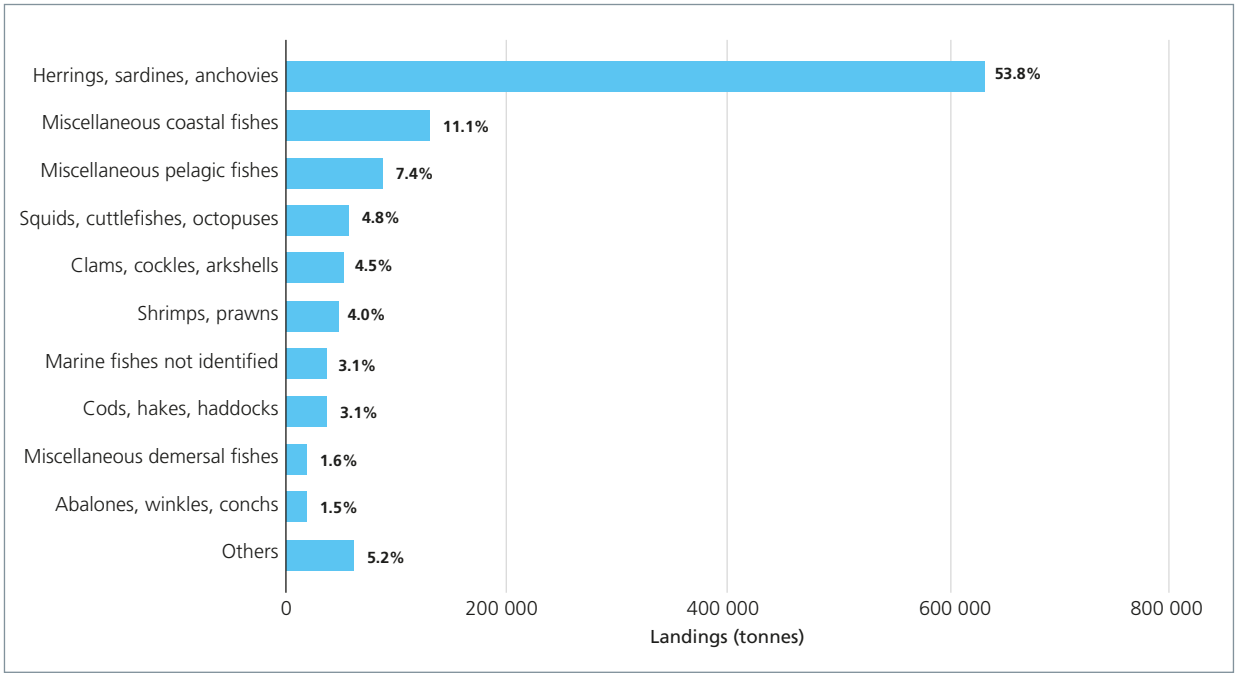
The three species groups most caught over the period 2016–2018 remain the same as those from the average landings reported in *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018): "Herrings, sardines, anchovies" (633 000 tonnes), "Miscellaneous coastal fishes" (130 000 tonnes) and "Miscellaneous pelagic fishes" (87 000 tonnes). These three groups constitute 72.3 percent of the total reported landings in the entire GFCM area of application, representing a slight increase from the 71.1 percent of the period 2014–2016. Seven other species groups contributing more than 1.5 percent to the total landings amount to 22.5 percent of the total landings, and the combination of all remaining species contributing less than 1.5 percent to the total landings amount to 5.2 percent overall (Table 10, Figure 19).

Compared with those of the whole GFCM area of application, the main species groups contributing to landings in just the Mediterranean Sea are very similar. Nonetheless, the contribution of small pelagic species (i.e. the combination of "Herrings, sardines, anchovies" and "Miscellaneous pelagic fishes") is moderately lower (44.3 percent of total Mediterranean landings versus 53.8 percent of total GFCM area of application landings). A slight increase is noted for "Miscellaneous coastal fishes" (4.3 percent more than in the whole GFCM area of application) and "Squids, cuttlefishes, octopuses" (2.4 percent more) (Figure 20).

TABLE 10. Total landings per year by major species group, 2016–2018

Species groups	Landings (tonnes)				
	2016	2017	2018	Average	% contribution
Herrings, sardines, anchovies	638 075	636 064	624 973	**633 037**	53.8
Miscellaneous coastal fishes	139 525	127 489	122 956	**129 990**	11.1
Miscellaneous pelagic fishes	85 018	80 199	96 319	**87 179**	7.4
Squids, cuttlefishes, octopuses	50 201	57 746	60 840	**56 263**	4.8
Clams, cockles, arkshells	43 417	51 230	62 619	**52 422**	4.5
Shrimps, prawns	45 653	48 342	45 729	**46 575**	4.0
Marine fishes not identified	38 531	38 274	32 706	**36 504**	3.1
Cods, hakes, haddocks	38 024	34 547	36 171	**36 247**	3.1
Miscellaneous demersal fishes	16 892	18 474	20 158	**18 508**	1.6
Abalones, winkles, conchs	15 093	18 780	20 404	**18 092**	1.5
Others	61 089	60 085	61 627	**60 934**	5.2

FIGURE 19. Total landings by major species group in the GFCM area of application, 2016–2018 average



In the Black Sea (Figure 21), the situation is opposite, with small pelagic species dominating (in particular "Herrings, sardines, anchovies," with 73.2 percent) compared to the Mediterranean (44.3 percent) (Figure 20) and smaller contributions from other species groups, reflecting the lower diversity of the catch (see subregional analysis below). Moreover, in comparison with the Mediterranean, where they account for 2.3 percent of the catch, "Clams, cockles, arkshells" are more relevant (the second group in terms of importance, representing 8.8 percent of the total catch, 4.3 percent more than in the whole GFCM area of application). "Shrimps and prawns," on the other hand, represent a very low percentage of the catch (0.7 percent contribution to the Black Sea's landings, 3.3 percent less than in the whole GFCM area of application) and are therefore included in the "Others" group.

FIGURE 20. Total landings by major species group in the Mediterranean Sea, 2016–2018 average

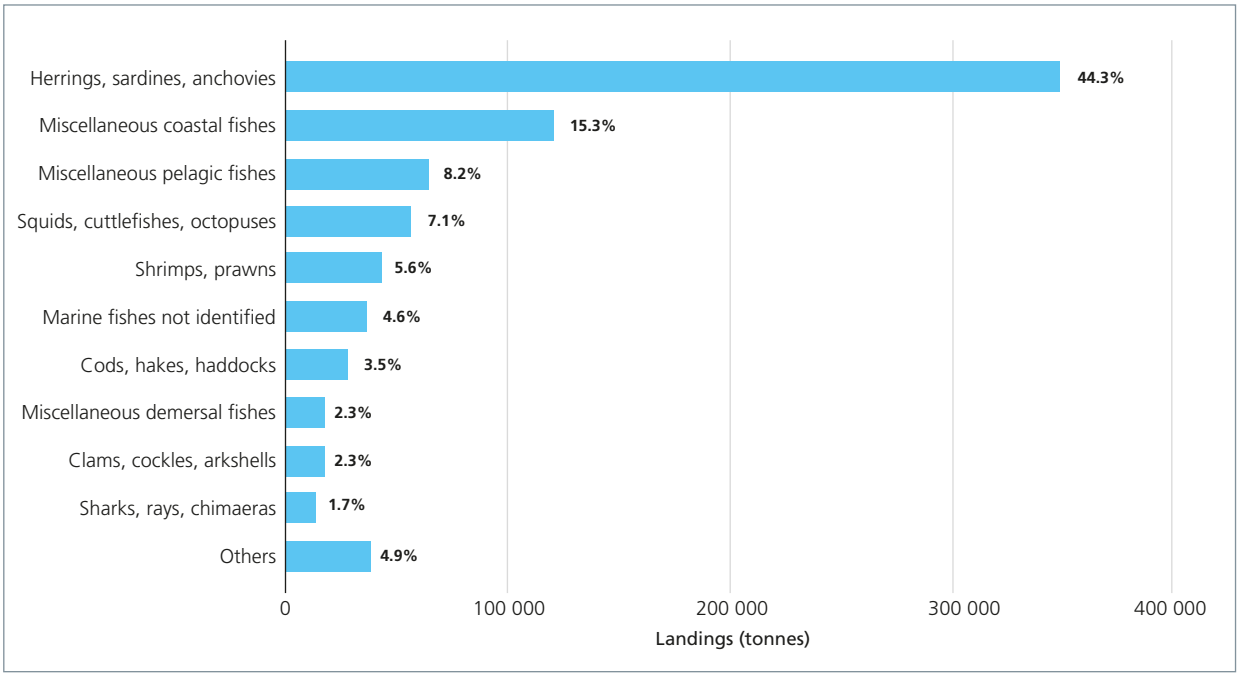
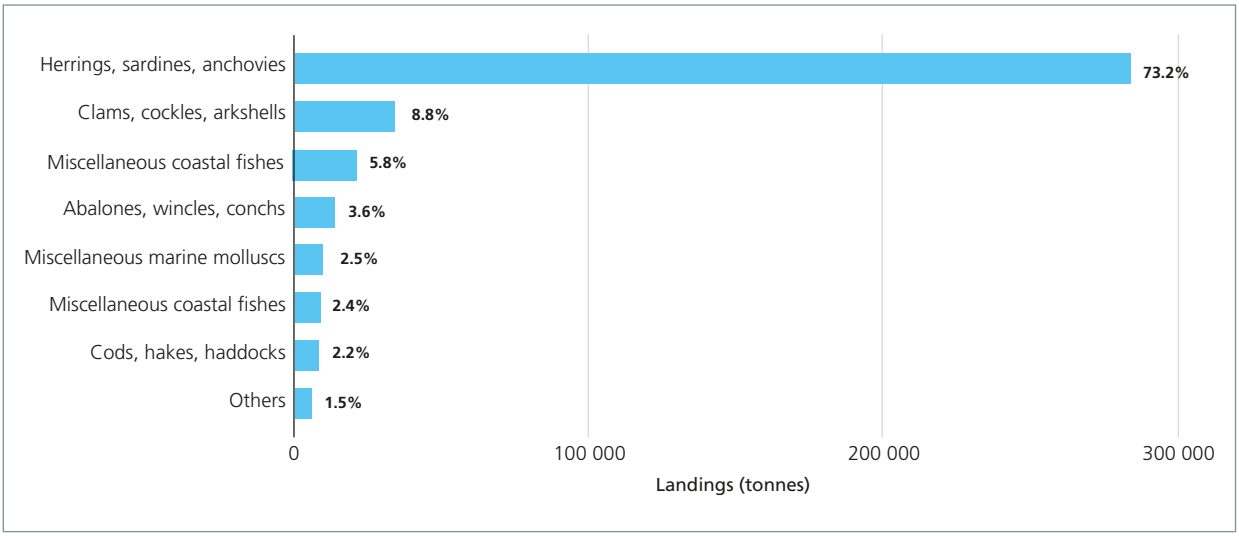


FIGURE 21. Total landings by major species group in the Black Sea, 2016–2018 average



In the whole GFCM area of application, European anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) continue to be the main species captured (333 340 tonnes and 185 700 tonnes on average, respectively), followed by European sprat (*Sprattus sprattus*) (57 400 tonnes). Seven species other than the small pelagic ones appear in the list of species contributing more than 1 percent to the total catch: two gastropods – striped venus clam (*Chamelea gallina*) and rapa whelk (*Rapana venosa*) – and five demersal species – gobies nei (Gobiidae), deep-water rose shrimp (*Parapenaeus longirostris*), bogue (*Boops boops*), European hake (*Merluccius merluccius*) and red mullet (*Mullus barbatus*) (Table 11, Figure 22).

Trends in landings of the main priority species (see Table 1) over the period 1970–2018 (Figure 23, Figure 24) reveal a variety of dynamics: landings of all the main pelagic species show large fluctuations, with European anchovy, for example, climbing from 275 100 tonnes

TABLE 11. Total landings per year by main commercial species accounting for more than 1 percent of total landings in the GFCM area of application, 2016–2018

Common name	Species (or group)	Landing (tonnes)				% contribution (2016–2018) average
		2016	2017	2018	Average	
European anchovy	*Engraulis encrasicolus*	317 768	343 420	338 835	**333 341**	28.4
Sardine	*Sardina pilchardus*	185 775	181 165	190 248	**185 729**	15.8
European sprat	*Sprattus sprattus*	79 087	54 314	38 880	**57 427**	4.9
Striped venus clam	*Chamelea gallina*	37 345	46 830	58 665	**47 613**	4.0
Sardinellas nei	*Sardinella* spp.	45 075	46 262	46 618	**45 985**	3.9
Marine fishes nei	*Osteichthyes*	38 531	38 274	32 706	**36 504**	3.1
Jack and horse mackerels nei	*Trachurus* spp.	23 124	21 867	27 748	**24 246**	2.1
Deep-water rose shrimp	*Parapenaeus longirostris*	19 955	23 838	25 912	**23 235**	2.0
Bogue	*Boops boops*	20 586	20 931	19 711	**20 409**	1.7
European hake	*Merluccius merluccius*	19 525	18 809	20 171	**19 501**	1.7
Marine molluscs nei	Mollusca	15 759	16 953	15 714	**16 142**	1.4
Red mullet	*Mullus barbatus*	16 040	15 642	16 099	**15 927**	1.4
Mediterranean horse mackerel	*Trachurus mediterraneus*	13 197	12 627	18 598	**14 807**	1.3
Rapa whelk	*Rapana venosa*	10 992	14 422	16 523	**13 979**	1.2
Atlantic chub mackerel	*Scomber colias*	11 440	14 503	12 269	**12 737**	1.1
Common pandora	*Pagellus erythrinus*	12 086	12 527	11 658	**12 090**	1.0
Others		305 207	288 831	294 136	**296 058**	25.2

FIGURE 22. Total landings by main species contributing at least 1 percent of the total catch in the GFCM area of application, 2016–2018 average

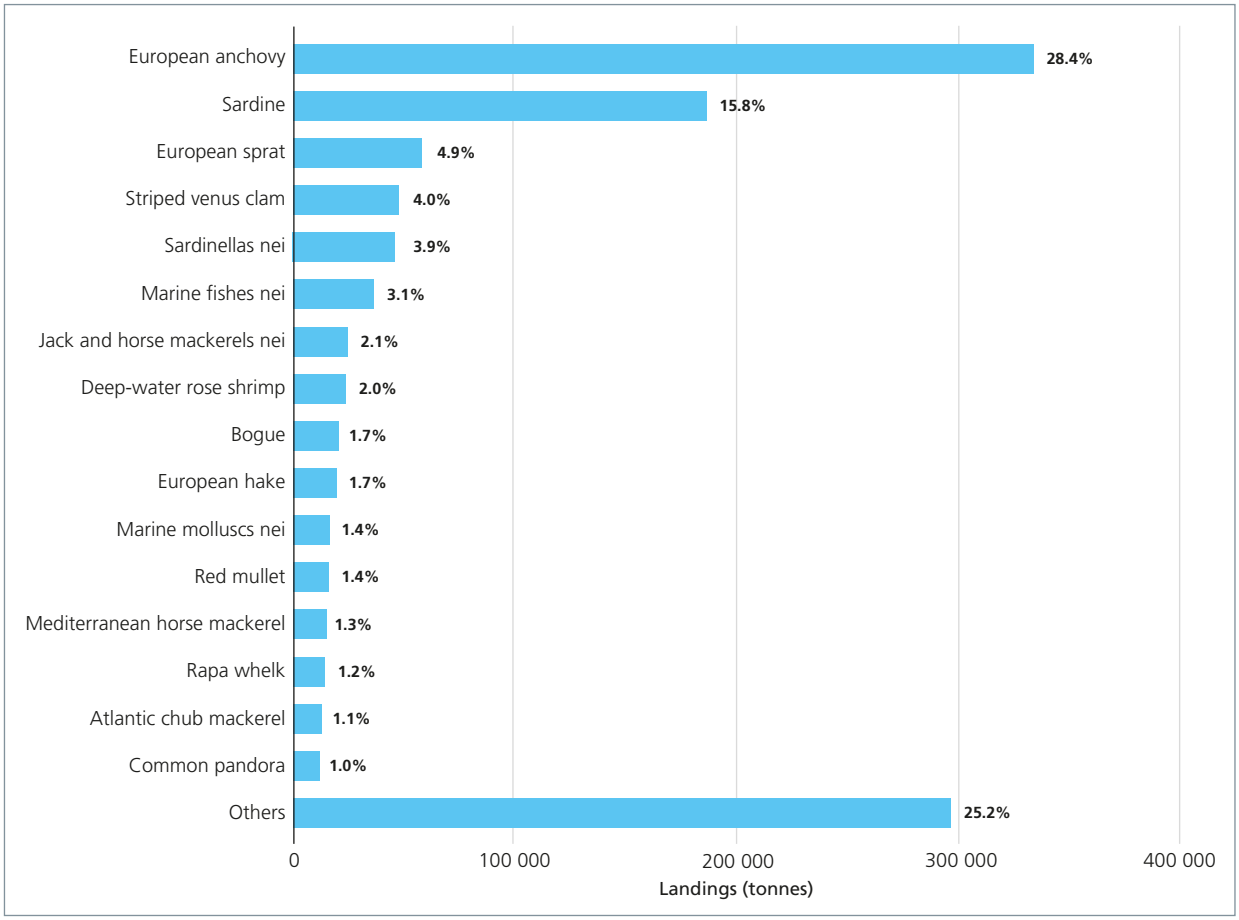


FIGURE 23. Landings per year of priority species averaging higher than 5 000 tonnes between 2016–2018 in the GFCM area of application, 1970–2018

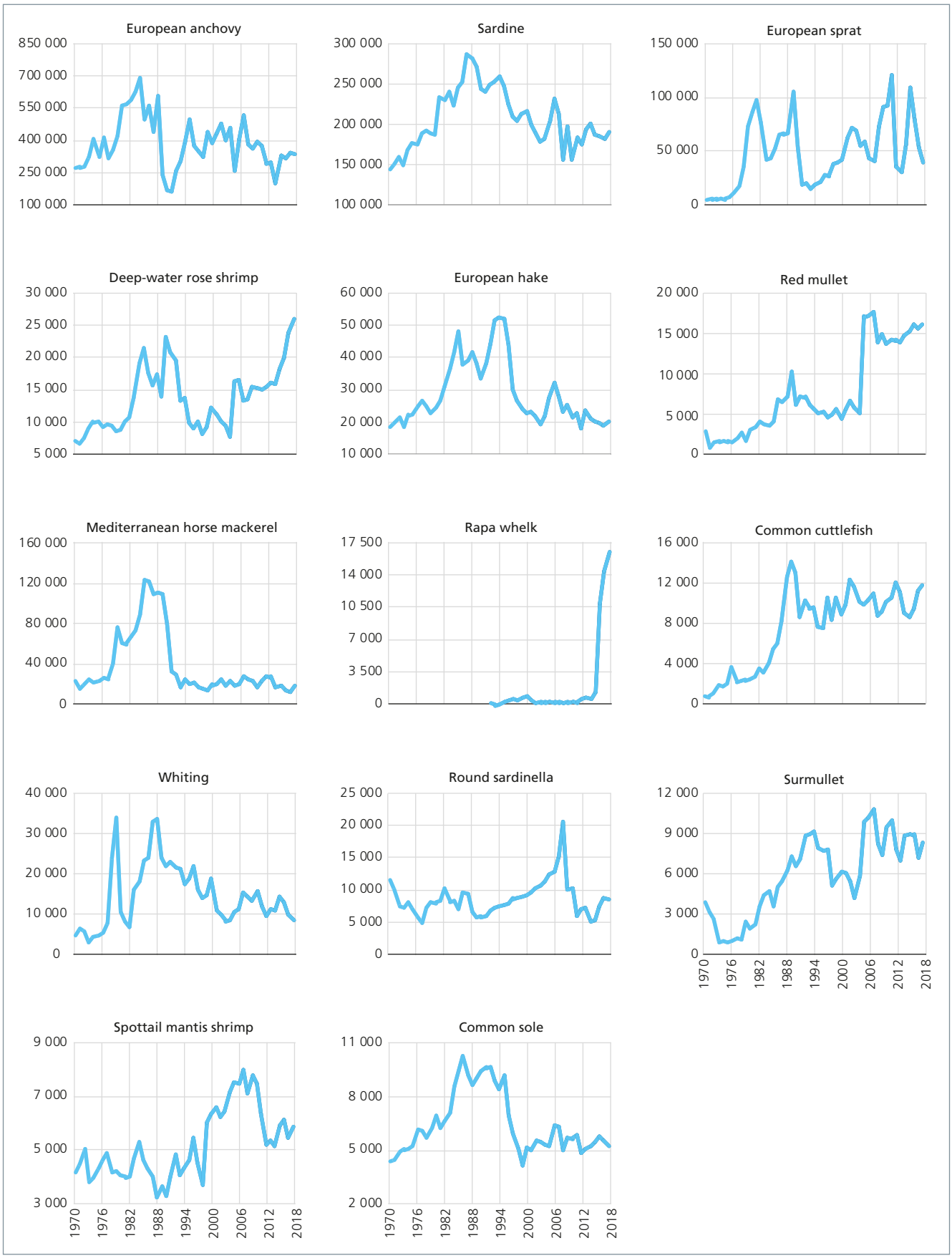
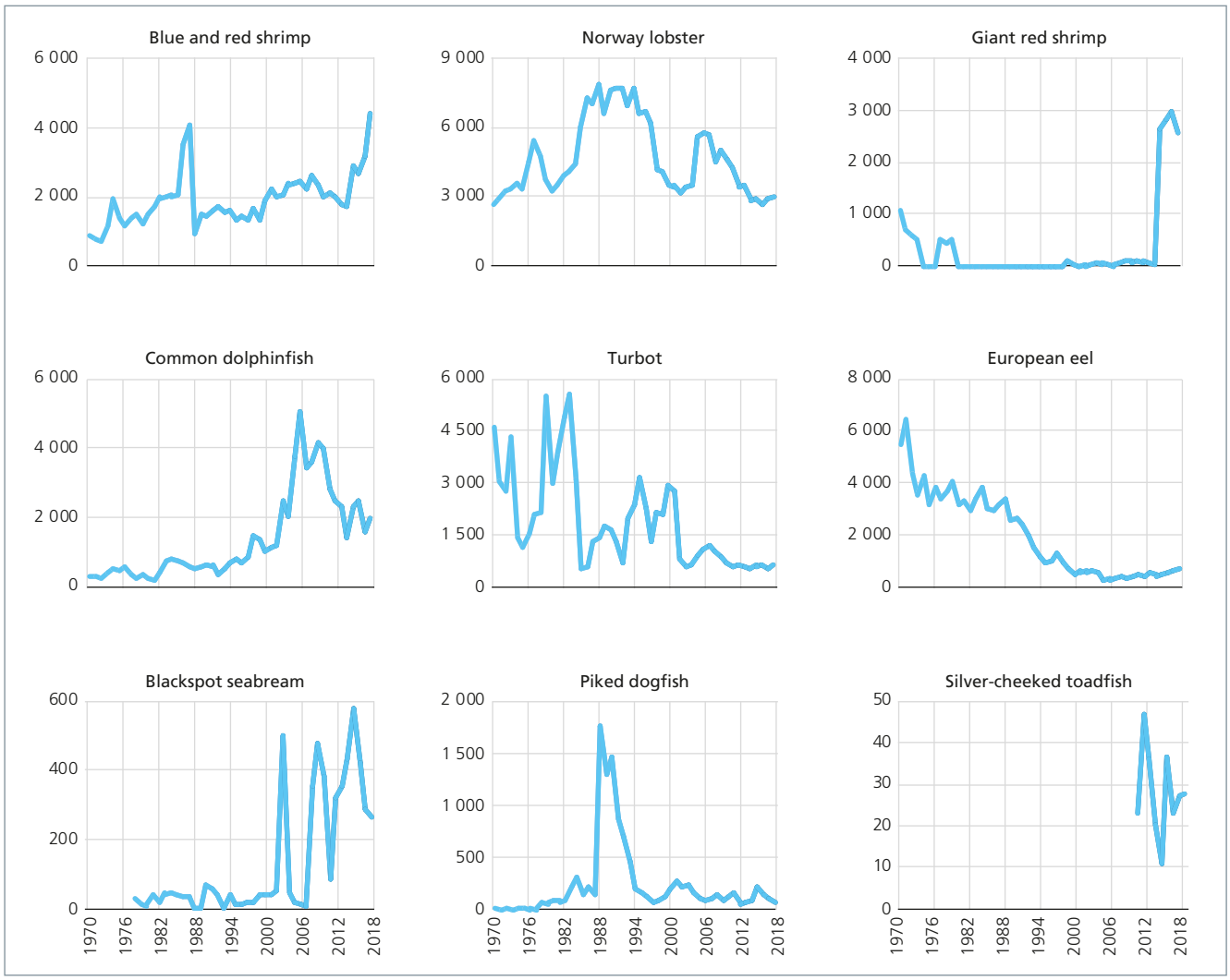
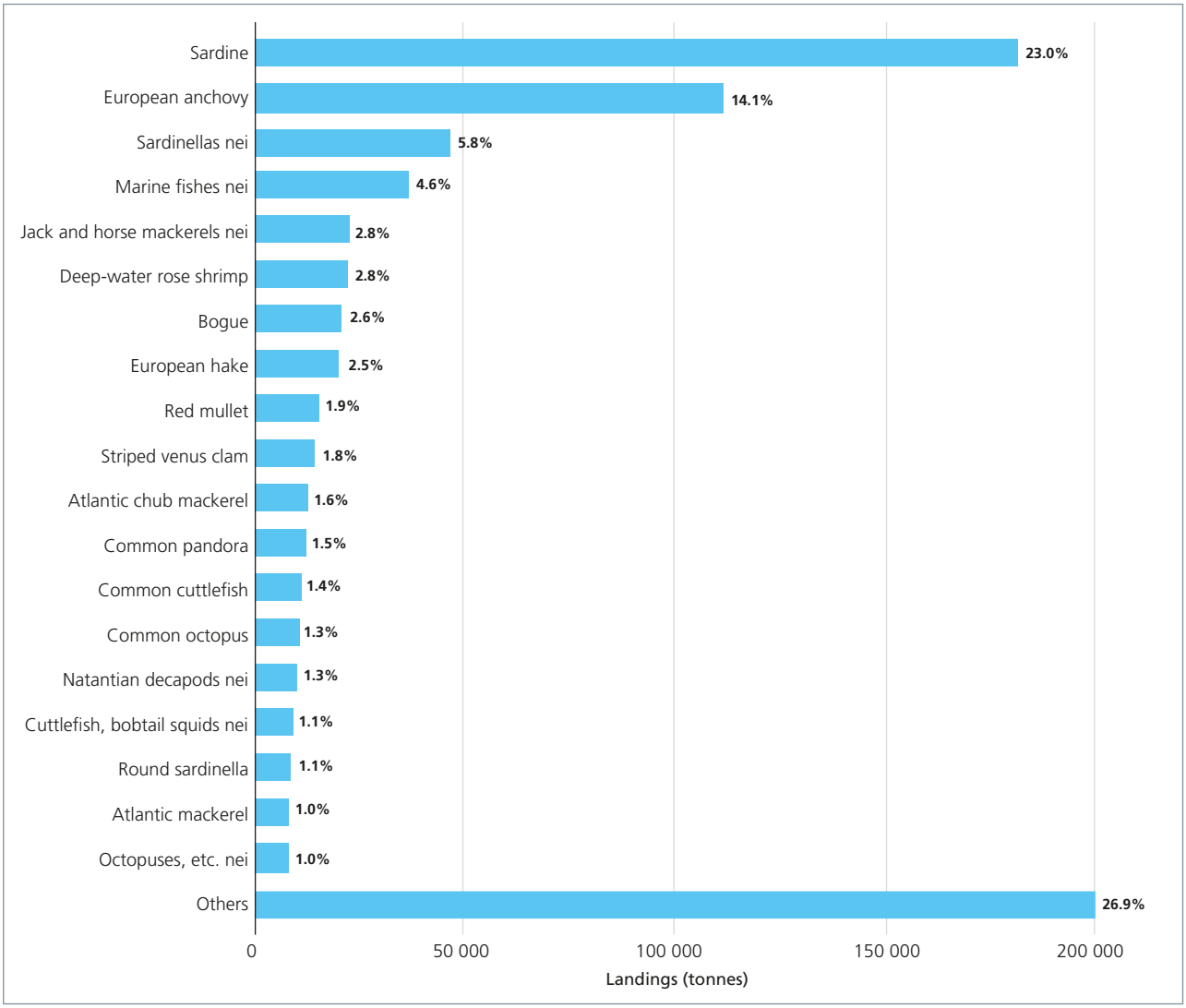


FIGURE 24. Landings per year of priority species averaging lower than 5 000 tonnes between 2016–2018 in the GFCM area of application, 1970–2018



in 1970 to 338 800 in 2018, with a collapse between 1989 and 1992 (reaching a minimum of 161 300 tonnes in 1991), followed by an irregular trend. Sardine landings fluctuate from 144 700 tonnes (1970) to 185 700 tonnes (2018) with a peak of 287 300 tonnes in 1987. An important fluctuation is also noted for European sprat, with landing values oscillating from around 4 400 tonnes in 1970 (minimum) to 38 800 in 2018 and a maximum of 120 900 tonnes in 2011. Round sardinella (*Sardinella aurita*) landings range from 11 600 tonnes (1970) to 8 500 tonnes (2018) with a peak of 20 500 tonnes in 2008. On the other hand, horse mackerel (*Trachurus mediterraneus)* catch shows an abrupt decline in the early 1990s (from around 100 000 tonnes to around 20 000 tonnes) and has since remained at a low level up to 2018. As for demersal species, European hake, whiting (*Merlangius merlangus*), Norway lobster (*Nephrops norvegicus*) and turbot (*Scophthalmus maximus*) show continuous declines in catch since the 1980s–1990s, while sole (*Solea solea*) shows an abrupt decline in the late 1990s (from more than 8 000 to less than 5 000 tonnes) and has remained at low levels since. Both mullet species, i.e. red mullet and surmullet (*Mullus surmuletus*), as well as priority mollusc and most of the crustacean species, i.e. common cuttlefish (*Sepia officinalis*), rapa whelk, spottail mantis shrimp (*Squilla mantis*), deep-water rose shrimp, blue and red shrimp (*Aristeus antennatus*) and giant red shrimp (*Aristaeomorpha foliacea*), show a generally increasing trend, with fluctuations in some cases over recent years. Among those, four priority species have experienced their maximum landings values in the most recent

FIGURE 25. Total landings by main species contributing at least 1 percent of the total catch in the Mediterranean Sea, 2016–2018 average

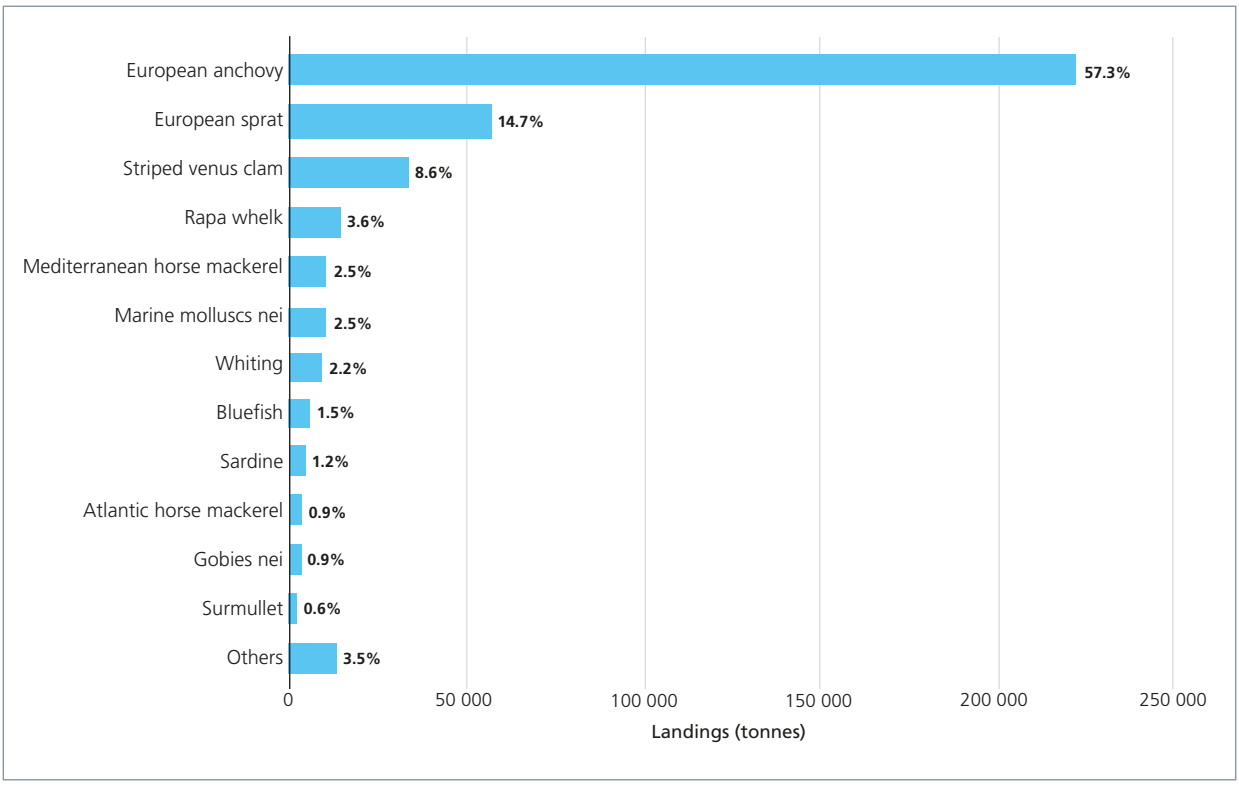


years: deep-water rose shrimp (25 900 tonnes in 2018), rapa whelk (16 500 tonnes in 2018), blue and red shrimp (4 400 tonnes in 2018) and giant red shrimp (2 900 tonnes in 2017). On the other hand, for species of conservation concern such as European eel (*Anguilla anguilla*) and piked dogfish (*Squalus acanthias*), a steep decline in catch, with close to zero catch in recent years, has been observed (Figure 23, Figure 24).

Two priority species are not included in Figure 24. The first one is red coral (*Corallium rubrum*) (Box 15), whose FAO data differ from their GFCM data from 2013 onwards, when GFCM data sources became the official submissions made and validated by CPCs to the GFCM in line with Recommendation GFCM/36/2012/1 , subsequently repealed by Recommendation GFCM/43/2019/4 on a management plan for the sustainable exploitation of red coral in the Mediterranean Sea. FAO statistics, on the other hand, also include catch estimates based on trade information. The second species not included is the Atlantic bonito (*Sarda sarda*), which has been listed recently as one of the priority species for the Black Sea, with its catch ranging from 20 700 tonnes (1970) to 35 500 tonnes (2018) across the whole GFCM area of application.

By basin, sardine and European anchovy continue to be the most relevant species in the Mediterranean Sea, together accounting for 37.1 percent of total landings (in line with data from the period 2014–2016, with a large diversity of species significantly contributing to

FIGURE 26. Total landings by main species contributing at least 0.5 percent of the total catch in the Black Sea, 2016–2018 average



the catch, i.e. 17 species accounting for at least 1 percent of total landings). In the Black Sea, the predominant species is undoubtedly the Black Sea anchovy (*Engraulis encrasicolus ponticus*), with 57.3 percent of total landings, followed by the European sprat, with 14.7 percent: both species account for 72 percent of landings in the region, i.e. around 2 percent more than in the period 2014–2016 (Figure 25, Figure 26).

CAPTURE FISHERIES PRODUCTION AT THE SUBREGIONAL LEVEL

The breakdown of capture fisheries production by GFCM subregions is here reproduced on the basis of the available landing data as transmitted by countries to the GFCM through the DCRF (Task I "Global figures of national fisheries," Task II.1 "Operating vessels and landings by fleet segment and GSA," Task II.2 Landing "Catch by fleet segment and GSA") for the period 2016–2018, which were then extrapolated to the total catch statistics for the Mediterranean and the Black Sea that are stored in the FAO-GFCM capture production database.

The results of the analysis show that the western Mediterranean continues to be the most productive Mediterranean subregion (22 percent of total landings, with 258 300 tonnes). The Adriatic Sea, the central Mediterranean and the eastern Mediterranean have almost the same share of landings, with 15.2 percent (179 000 tonnes), 14.7 percent (172 300 tonnes) and 15.2 percent (178 200 tonnes), respectively. The Black Sea has the highest capture fisheries production in weight overall (33 percent of the total, with 387 800 tonnes) (Figure 27).

In general, the dynamics reported in *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018) continue to hold true, with the large majority of the catch in a given subregion being declared by countries belonging to this subregion and only a few cases of fleets from countries outside the subregion contributing a small percentage of its total catch (Figure 28).

In the western Mediterranean, Algeria (39.9 percent) brings in the largest share of landings by weight, followed by Spain (30.4 percent) and Italy (16.3 percent). The three together account for 86.5 percent of all

FIGURE 27. Total landings by GFCM subregion, 2016–2018 average

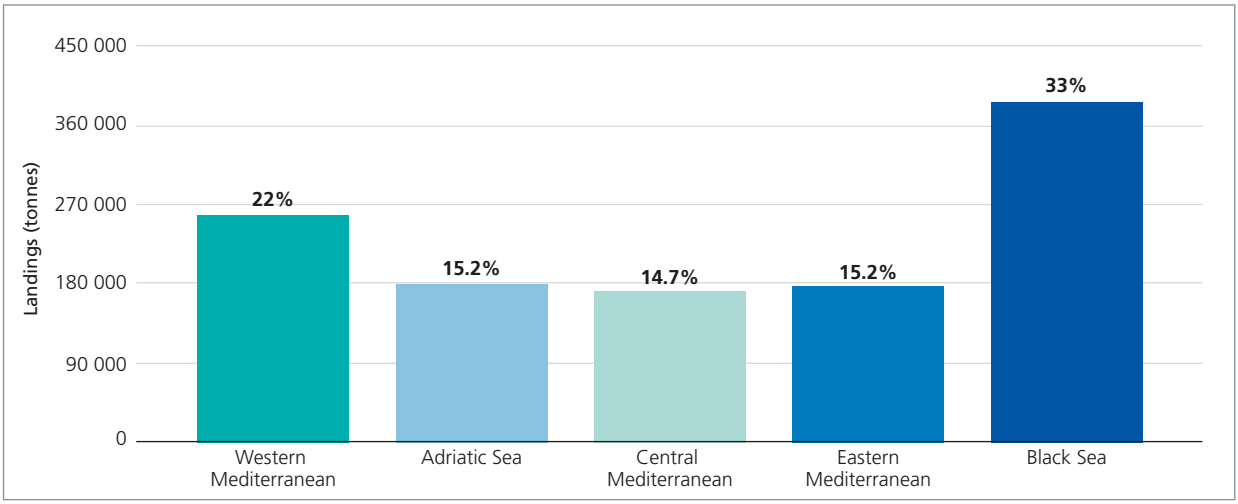


FIGURE 28. Average annual landings by country within each GFCM subregion, 2016–2018

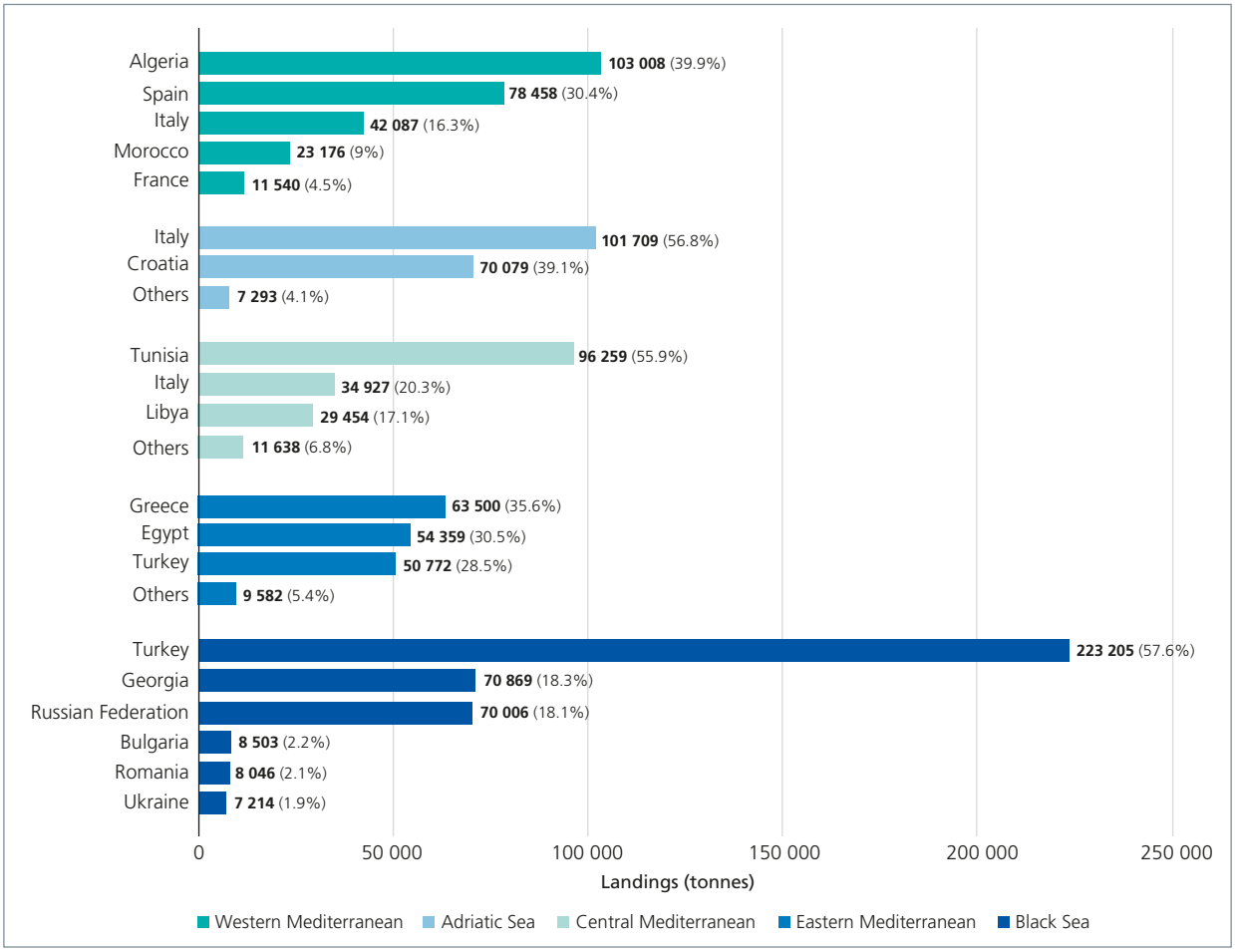
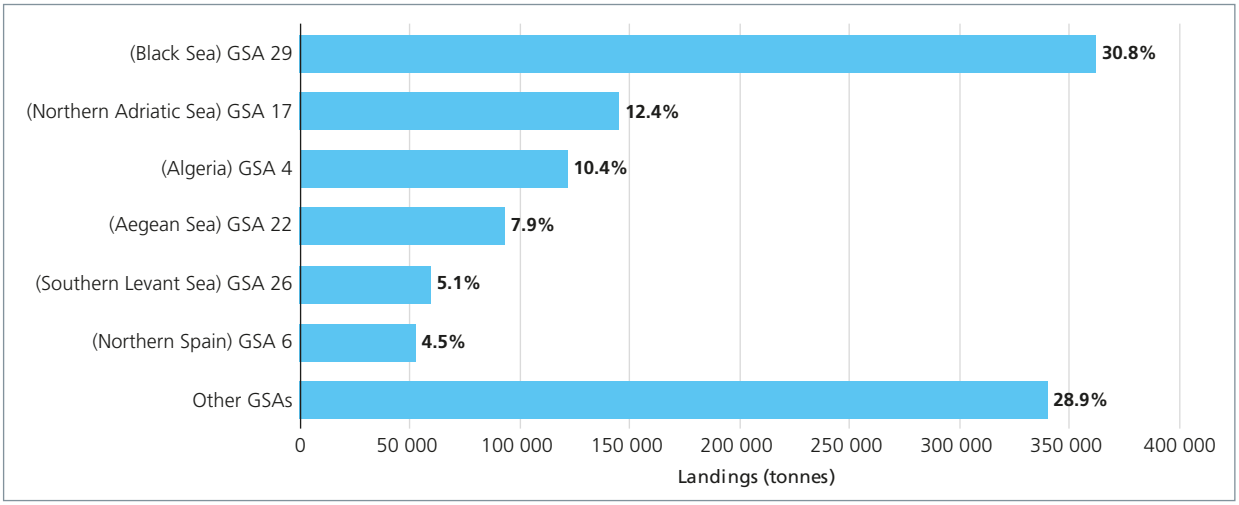


FIGURE 29. Average annual landings by geographical subarea, 2016–2018



landings in the subregion, with Morocco and France contributing the remaining 9 percent and 4.5 percent, respectively.

In the Adriatic Sea, landings by weight are dominated by Italy (56.8 percent) and Croatia (39.1 percent), which account for 95.9 percent of all landings in the subregion, followed by Albania (3.5 percent), Montenegro (0.5 percent) and Slovenia (0.1 percent).

In the central Mediterranean, landings by weight are dominated by Tunisia (55.9 percent), followed by Italy (20.3 percent) and Libya (17.1 percent), the three of which account for 93.2 percent of all landings in the subregion, followed by Greece (5.5 percent) and Malta (1.2 percent).

In the eastern Mediterranean, landings by weight are mostly split between Greece (35.6 percent), Egypt (30.5 percent) and Turkey (28.5 percent), which together account for 94.6 percent of all landings in the subregion, followed by Lebanon (1.8 percent), Palestine (1.7 percent), the Syrian Arab Republic (0.9 percent), Israel (0.6 percent) and Cyprus (0.4 percent).

Finally, in the Black Sea, Turkey brings in the largest share of landings by weight (57.6 percent), followed by Georgia (18.3 percent), the Russian Federation (18.1 percent), Bulgaria (2.2 percent), Romania (2.1 percent) and Ukraine (1.9 percent).

A further breakdown of the available data at the GSA level (Figure 29) reveals that six GSAs alone contribute 71.1 percent of total landings in the whole GFCM area of application, or around 835 500 tonnes. Geographical subarea 29 (Black Sea), the largest GSA, has the largest share of landings with 30.8 percent of the total (362 400 tonnes), i.e. more than double the contribution of the second most productive GSA, namely GSA 17 (northern Adriatic Sea), which accounts for 145 400 tonnes (12.4 percent of the total). The third most important of the GSAs with landings greater than 100 000 tonnes is GSA 4 (Algeria), accounting for 10.4 percent, or 121 700 tonnes. Three GSAs have landings between 50 000 and 100 000 tonnes: GSA 22 (Aegean Sea) at 7.9 percent (93 300 tonnes), GSA 26 (southern Levant Sea) at 5.4 percent (59 500 tonnes) and GSA 6 (northern Spain) at 4.8 percent (52 800 tonnes). The remaining 23 GSAs all together contribute 28.9 percent of total landings in the whole GFCM area of application, with around 340 200 tonnes (Figure 29).

In 2018, 15.7 percent (126 300 tonnes) of the total catch in the Mediterranean Sea was landed in ten ports, mainly located in the southern part of the basin, whereas the ten main landing ports in the Black Sea receive around 42 percent (159 000 tonnes) of the total landings in this area (Box 7).

Box 7. Main landing ports in the Mediterranean and the Black Sea

The GFCM Secretariat performed an analysis of the main fishing ports in the Mediterranean and the Black Sea in terms of landings and operating vessels. To this end, an ad hoc data call was launched at the beginning of 2020 among the countries involved in the region, since the necessary information was not requested through any of the existing GFCM recommendations. The results of the analysis encompassed 2018 data from 178 national ports in total, as transmitted by 22 countries: Albania, Algeria, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Egypt, France, Georgia, Greece, Israel, Italy, Lebanon, Malta, Morocco, Romania, Slovenia, Spain, Syrian Arabic Republic, Tunisia, Turkey and Ukraine.

Main landing ports in terms of volume of landings

Based on the available information[1], the ten main ports in terms of volume of landings in the entire GFCM area of application are found in the following places: five in the Mediterranean Sea (one Algerian, two Egyptian and two Tunisian) and five in the Black Sea (one Georgian and four Turkish). This group of ports receive around 15 percent of total landings in the whole area, while their operating vessels account for less than 1.8 percent of the total fleet in 2018.

The breakdown by area shows that the ten most important ports in terms of volume of landings in the Mediterranean Sea, which receive around 15 percent of the total landings, are all located in the southern part of the basin (Egypt, Tunisia and Algeria), with the exception of one Italian port.

With regard to the Black Sea, nine of the main ports in terms of the volume of landings are Turkish and one is Georgian. Together, they account for around 37 percent of the total landings in this area.

(cont.)

[1] Missing data on the landings by ports: Libya and Montenegro.

GFCM area of application

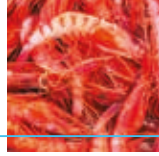
Port	Country	Landings (tonnes)	Percentage
Terme B.B. (Black Sea)	Turkey	27 790	2.16%
Ünye B.B. (Black Sea)	Turkey	26 045	2.03%
Samsun Merkez B.B. (Black Sea)	Turkey	25 893	2.01%
Poti (Black Sea)	Georgia	23 035	1.79%
Izbet Elborg (Mediterranean)	Egypt	16 649	1.30%
Chebba (Mediterranean)	Tunisia	16 466	1.28%
Teboulba (Mediterranean)	Tunisia	15 229	1.19%
Cide B.B. (Black Sea)	Turkey	14 999	1.17%
Port-Saied (Mediterranean)	Egypt	13 747	1.07%
Bouzedjar (Mediterranean)	Algeria	12 358	0.96%

Mediterranean Sea

Port	Country	Landings (tonnes)	Percentage
Izbet Elborg	Egypt	16 649	1.95%
Chebba	Tunisia	16 466	1.93%
Teboulba	Tunisia	15 229	1.79%
Port-Saied	Egypt	13 747	1.61%
Bouzedjar	Algeria	12 358	1.45%
Kelibia	Tunisia	10 997	1.29%
Beni-Saf	Algeria	10 771	1.26%
Borg Elburullus	Egypt	10 588	1.24%
Ghazaouet	Algeria	10 043	1.18%
Chioggia	Italy	9 524	1.12%

Black Sea

Port	Country	Landings (tonnes)	Percentage
Terme B.B.	Turkey	27 790	6.41%
Ünye B.B.	Turkey	26 045	6.01%
Samsun Merkez B.B.	Turkey	25 893	5.98%
Poti	Georgia	23 035	5.32%
Cide B.B.	Turkey	14 999	3.46%
Ardeşen B.B.	Turkey	10 957	2.53%
Kaynarca B.B.	Turkey	10 179	2.35%
Melenağzı	Turkey	9 539	2.20%
Bağırganlı Limanı	Turkey	5 870	1.35%
Karasu Yenimahalle B.B.	Turkey	4 728	1.09%



Box 7. (continued)

Main landing ports in terms of number of vessels operating from those ports

The ranking of the ten main ports in the entire GFCM area of application completely changes when the number of operating vessels contributing to the landings in these ports becomes the top consideration. Based on the available information[2], the main ports under these criteria are all located in the Mediterranean Sea (four Tunisian, three Moroccan, two Algerian and one Syrian). Together, they account for around 6.7 percent of all the fishing vessels operating in the GFCM area of application in 2018 (7.7 percent of just Mediterranean vessels) and contribute 5 percent of the region's total landings (8 percent of just Mediterranean total landings).

In the Black Sea, seven out of the ten most important ports are located in Bulgaria while three are in Turkey. They account for around 7.7 percent of the fishing vessels operating in the Black Sea in 2018 and contribute 8 percent of the total landings.

[2] Missing data on the number of fishing vessels by port: Bosnia and Herzegovina, Egypt, France, Lebanon, Libya and Montenegro.

GFCM area of application

Port	Country	Vessels
Zarzis	Tunisia	1 024
Chebba	Tunisia	867
Nador	Morocco	696
Sfax	Tunisia	684
Al Hoceima	Morocco	675
Tanger Ville	Morocco	572
Annaba	Algeria	480
El Kala	Algeria	336
Mahdia	Tunisia	332
Latakia Azhari	Syrian Arab Republic	290

Black Sea

Port	Country	Vessels
Varna	Bulgaria	157
Samsun Merkez B.B.	Turkey	132
Sozopol	Bulgaria	105
Nesebar	Bulgaria	100
Ünye B.B.	Turkey	87
Pomorie	Bulgaria	75
Balchik	Bulgaria	71
Shabla	Bulgaria	69
Terme B.B.	Turkey	52
Kavarna	Bulgaria	41

SUBREGIONAL CAPTURES BY SPECIES

In terms of species contribution in the different subregions (Figure 30), sardine is the main capture species in the Adriatic Sea (72 400 tonnes, 39.4 percent), the western Mediterranean (65 400 tonnes, 24.7 percent) and the central Mediterranean (16 700 tonnes, 10.3 percent), while European anchovy is the predominant species in the eastern Mediterranean (28 600 tonnes, 15.8 percent) and the Black Sea (222 200 tonnes, 57.3 percent).

In the western Mediterranean, European anchovy (39 300 tonnes, 14.8 percent) and sardinellas nei (*Sardinella* spp.) (22 900 tonnes, 8.6 percent) are the second and the third main species, whereas the remaining 51.9 percent (137 500 tonnes) corresponds to a large number of species contributing to the catch in this region (Figure 30).

In the central Mediterranean, other relevant species are sardinellas nei (12 900 tonnes, 8 percent), European anchovy (9 200 tonnes, 5.7 percent) and common Pandora (*Pagellus erythrinus*) (8 800 tonnes, 5 percent). The sum of all other species, each contributing less than 5 percent, constitutes the remaining 70.7 percent of the total with 114 800 tonnes (Figure 30).

In the Adriatic Sea, four species, namely sardine (72 400 tonnes, 39.4 percent), European anchovy (34 000 tonnes, 18.5 percent), striped

FIGURE 30. Average annual landings of the main landed species in each GFCM subregion, 2016–2018

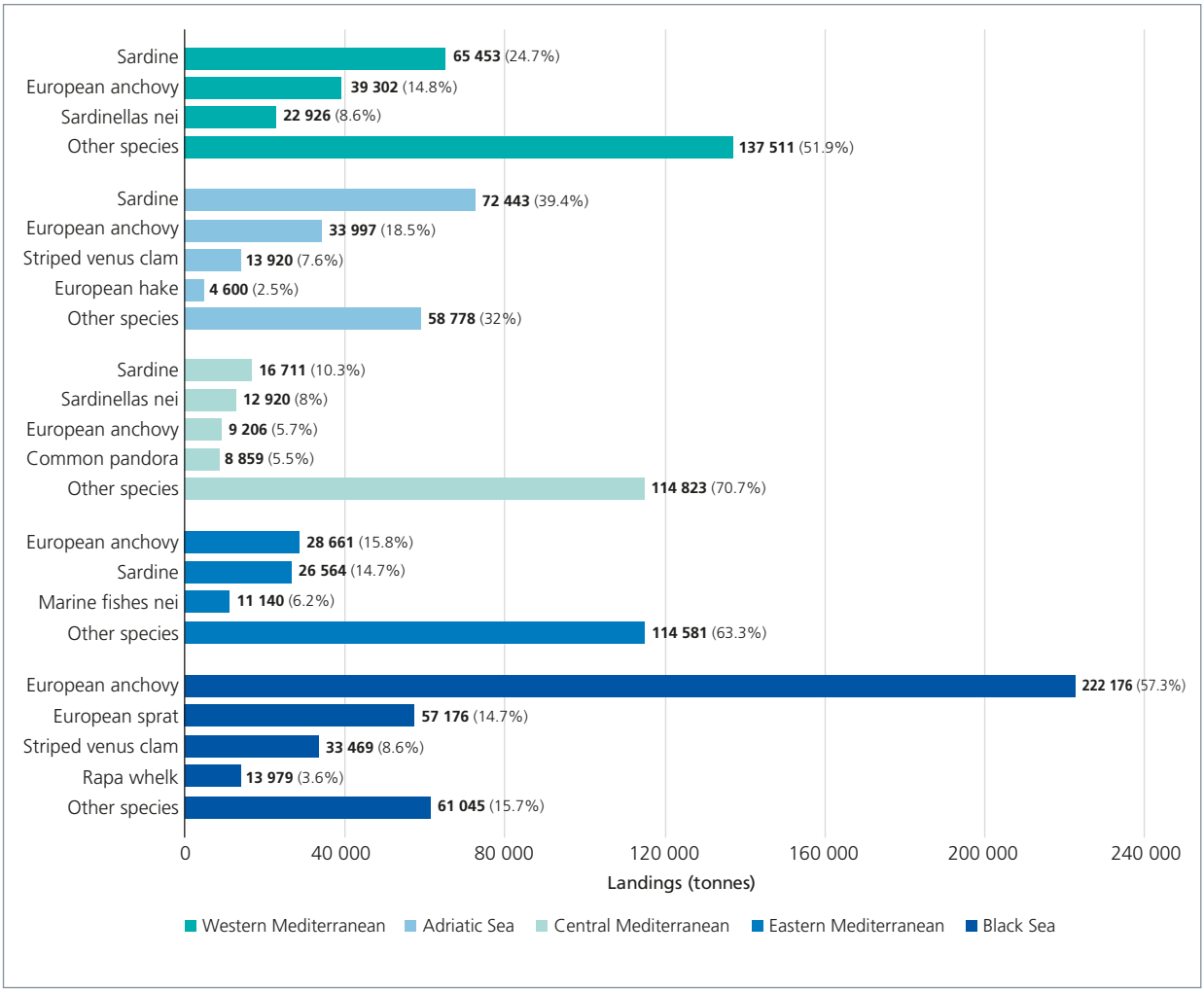
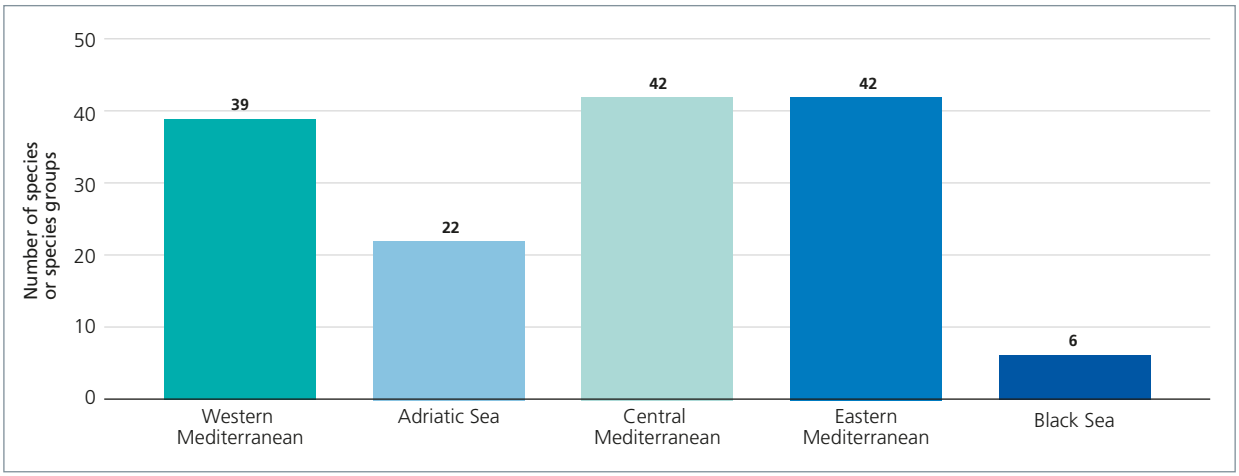


FIGURE 31. Number of species or species groups accounting for 90 percent of the total catch of each GFCM subregion



venus clam (13 900 tonnes, 7.6 percent) and European hake (4 600 tonnes, 2.5 percent) account for 68 percent of the landings (Figure 30).

In the eastern Mediterranean, sardine (26 500 tonnes, 14.7 percent) and marine fishes nei (11 100 tonnes, 6.2 percent) are the other relevant species, with all the others accounting for the remaining 63.3 percent (Figure 30).

In the Black Sea, in addition to European anchovy, species of particular importance in terms of landings are European sprat (57 176 tonnes, 14.7 percent), striped venus clam (33 500 tonnes, 8.6 percent) and rapa whelk (13 980 tonnes, 3.6 percent), with all the other species contributing the remaining 15.7 percent of the total (61 045 tonnes) (Figure 30).

Overall, the diversity of species in the catch is much higher in the western, central and eastern Mediterranean (nearly 40 species). In comparison, the lowest number of species that, summed together, account for 90 percent of the total catch in the Adriatic and the Black Sea is lower (slightly more than 20 for the Adriatic and less than ten for the Black Sea) (Figure 31).

3. Socio-economic characteristics

Socio-economic data are a key component of the scientific advice required for the evidence-based management of fisheries and the development of appropriate policies and strategies, especially in relation to promoting the long-term sustainability of resources and fleets. Monitoring the economic status of fisheries and socio-economic dynamics is also essential to the adequate integration of fisheries into blue economy processes, particularly for small-scale fisheries (SSF) and their related activities, which are significant contributors to the livelihoods and food security of coastal populations in the Mediterranean and Black Sea region.

The regular collection and transmission of socio-economic data support the development of time series analyses of landing values and average annual prices for commercial species, as well as of trends in the social and economic performance of the sector (e.g. revenue, gross value added, employment, remuneration). Data are also expected to support analyses of the profitability of fleets and to improve the knowledge of fleet costs and their breakdown into different categories.

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 Black Sea. A regional overview is first presented, providing a detailed analysis of revenue and employment at the regional, subregional

and national levels, as well as by fleet segment group. The chapter then provides further analysis of the commercially important species in the region, the economic performance of the fishing fleet, the social characteristics of capture fisheries and aspects related to the marketing and trade of landings. Particular focus is given to the analysis by subregion and fleet segment group.

SOURCES OF INFORMATION

The data used to compile the analyses contained within this chapter were collected under the GFCM Data Collection Reference Framework (DCRF) Task VI relating to socio-economic aspects, including Task VI.1 on economic and social data, Task VI.2 on operating costs, Task VI.3 on species value and Task VI.4 on other economic aspects (for more information on the DCRF, see Box 1). Specific analyses were also carried out based on data from a group of selected countries that participated in a GFCM socio-economic survey initiative, an activity foreseen by the GFCM mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries (Box 8). The results of the socio-economic survey were also used to complement official DCRF transmissions (this was, for instance, the case for Algeria and Turkey where some socio-economic variables included in Tasks VI.2 and VI.4 were adjusted to support coherency). The trade data used in this chapter are from the FAO Fisheries Commodities Production and Trade database. All monetary values listed in this chapter have been adjusted for inflation and are listed as constant 2018 USD to facilitate comparison across reference years (World Bank, 2020a, 2020b).

The reference year for all analyses was 2018, with some exceptions where data were unavailable, incomplete or inconsistent for this year. In order to allow for the analyses of specific indicators at the regional (GFCM area of application) and subregional (western Mediterranean, central Mediterranean, Adriatic Sea, eastern Mediterranean and Black Sea) levels

Box 8. GFCM socio-economic surveys

The GFCM mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries recognizes the importance of accurate, timely and complete socio-economic data on fisheries in the region in order to enhance the advice provided to the Commission. It calls for the implementation of a comprehensive regional survey on the socio-economic characteristics of fisheries in the Mediterranean and the Black Sea, with a particular emphasis on collecting robust data on the impacts of small-scale fisheries (SSF). To this end, the GFCM Secretariat assisted with capacity building in select contracting parties and cooperating non-contracting parties (CPCs), strengthening their data collection systems for socio-economic factors of the fisheries sector. The quality and completeness of European Union data submissions are also expected to improve, especially towards reaching common objectives set forth and facilitating a regional assessment. These submissions include the information from all CPCs to be reported in future issues of *The State of Mediterranean and Black Sea Fisheries*. The capacity building support consisted of technical assistance to carry out socio-economic surveys, including survey design and data quality control, processing and analysis, in the following participating countries: Algeria, Egypt, Lebanon, Montenegro, Morocco, Tunisia, Turkey and Ukraine.

Sample surveys were conducted in each participating country, covering the full national fleet and following a harmonized regional methodology as set out in the *Handbook for fisheries socio-economic sample survey – principles and practice* (Pinello, Gee and Dimech, 2017). The questionnaire was slightly modified for each country in order to adapt to the national specificities and needs while still ensuring that countries could fulfil their data reporting requirements for all fleet segments and geographical subareas, in line with Task VI of the GFCM Data Collection Reference Framework (DCRF).

Beyond seeking to ensure that all participating countries were able to successfully submit socio-economic data through the DCRF, in line with the conclusions of the first meeting of the Working Group on Small-Scale Fisheries held in 2017 (GFCM, 2017a), the surveys also sought to collect additional information that could shed further light on the socio-economic characteristics of fisheries in the region, particularly of the SSF fleet segment group. These surveys included information on variables not requested under the DCRF such as the destination of the catch at first sale, demographic characteristics of fishers and more.

The results of these surveys are reflected through more accurate and complete DCRF Task VI data submissions, which have supported the improved analyses presented in this chapter. This chapter has been further enhanced by the inclusion of new indicators and preliminary analyses arising from the additional data collected in the context of the socio-economic surveys.

(see Figure 1), some data from previous years were considered to complete the datasets[5].

In general, it should be stressed that the quality of socio-economic data submissions has significantly improved in comparison with 2016, the reference year supporting the preparation of the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018), although the quality of data still demands improvement for several indicators. In some cases, due to incomplete socio-economic data relating to specific geographical subareas and/or fleet segment groups as a result of these quality issues, it was necessary to exclude certain contracting parties and cooperating non-contracting parties (CPCs) or some of their fleet segment groups from select aggregated analyses. Where a limited number of CPCs were included for specific indicators, it is noted in the text.

Moreover, due to limited data availability, Georgia and Montenegro were only considered in the regional overview focusing on total employment and total revenues (at first sale)[6] and were not considered in the analysis of more specific socio-economic indicators by subregions. Finally, data for Bosnia and Herzegovina, Israel, Libya and the Syrian Arab Republic, as well as the Russian Federation and Palestine, were not reported in any of the analyses within the present chapter on socio-economics due to a lack of availability.

Specific analyses by fleet segment group make reference to the fleet segment groups outlined in Table 6, namely: small-scale vessels; trawlers and beam trawlers; purse seiners and pelagic trawlers; and other fleet segments. However, to better analyse the economic characteristics of these groups, particularly their cost structures, this chapter further divides the "Other fleet segments" group into "Other: longliners and tuna purse seiners" and "Other: polyvalent vessels and dredgers". Furthermore, as noted in Chapter 1, the aggregation of fleet segments included within the group "Small-scale vessels" differs from the previous editions of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2016; 2018) in order to reflect the conclusions of the second meeting of the Working Group on Small-Scale Fisheries (GFCM, 2019b). Toward the same end, SSF refers to the "Small-scale vessels" fleet segment group, whereas all other fleet segment groups are referred to collectively as "Industrial fisheries".

Another important methodological aspect to underline is how significant improvements in the transmission of socio-economic data to DCRF over the last two to three years have facilitated undertaking deeper analyses, which are included within this socio-economic chapter. However, the available data are not yet adequate to present a time series or comparative analysis of major trends for most socio-economic indicators. Such a dynamic analysis, which is of particular relevance for the increased inclusion of socio-economics in fisheries management, is expected to be introduced in subsequent editions of *The State of Mediterranean and Black Sea Fisheries*.

REGIONAL SOCIO-ECONOMIC REVIEW

The total revenue from marine capture fisheries in the GFCM area of application is estimated to be USD 3.6 billion in 2018 (USD 3.4 billion in the Mediterranean and USD 251 million in the Black Sea). Six countries, namely Italy, Greece, Turkey, Spain, Algeria and Tunisia, account for 83 percent of the total revenue (Figure 32). As such, this estimate represents the value at first sale of fish from vessel-based marine capture fisheries in FAO major fishing area 37, prior to any processing or value-addition activities. Shore-based fishing activities, such as gleaning (i.e. foot-based fishing, such as shellfish collecting), and some fishing activities performed by vessels that are not registered (e.g. vessels below 5 gross tonnage (GT) in the case of Tunisia) are not considered in this estimate. The wider economic impact of fisheries along the value chain in the region, including direct and indirect and induced effects, is estimated to be 2.6 times the value at first sale (FAO, 2018), or approximately USD 9.4 billion.

A reconstruction of revenue (adjusted for inflation and calculated as constant 2018 USD) from 2013 to 2018 shows that total revenue has fluctuated between USD 3.2 and 3.7 billion over this period (Figure 33). Compared to 2016 (the reference year for the 2018 edition of *The State*

[5] Reference years are as follows: Albania (2018), Algeria (2018), Bulgaria (2018), Croatia (2018), Cyprus (2018), Egypt (2018), France (2018), Greece (2016), Italy (2018), Lebanon (2018), Malta (2018), Morocco (2017), Romania (2018), Slovenia (2018), Spain (2017), Tunisia (2018), Turkey (2018) and Ukraine (2018).

[6] Data sources for these countries are from *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018), with the following reference years: Georgia (2016) and Montenegro (2015).

FIGURE 32. Revenue from marine capture fisheries by GFCM contracting party and cooperating non-contracting party

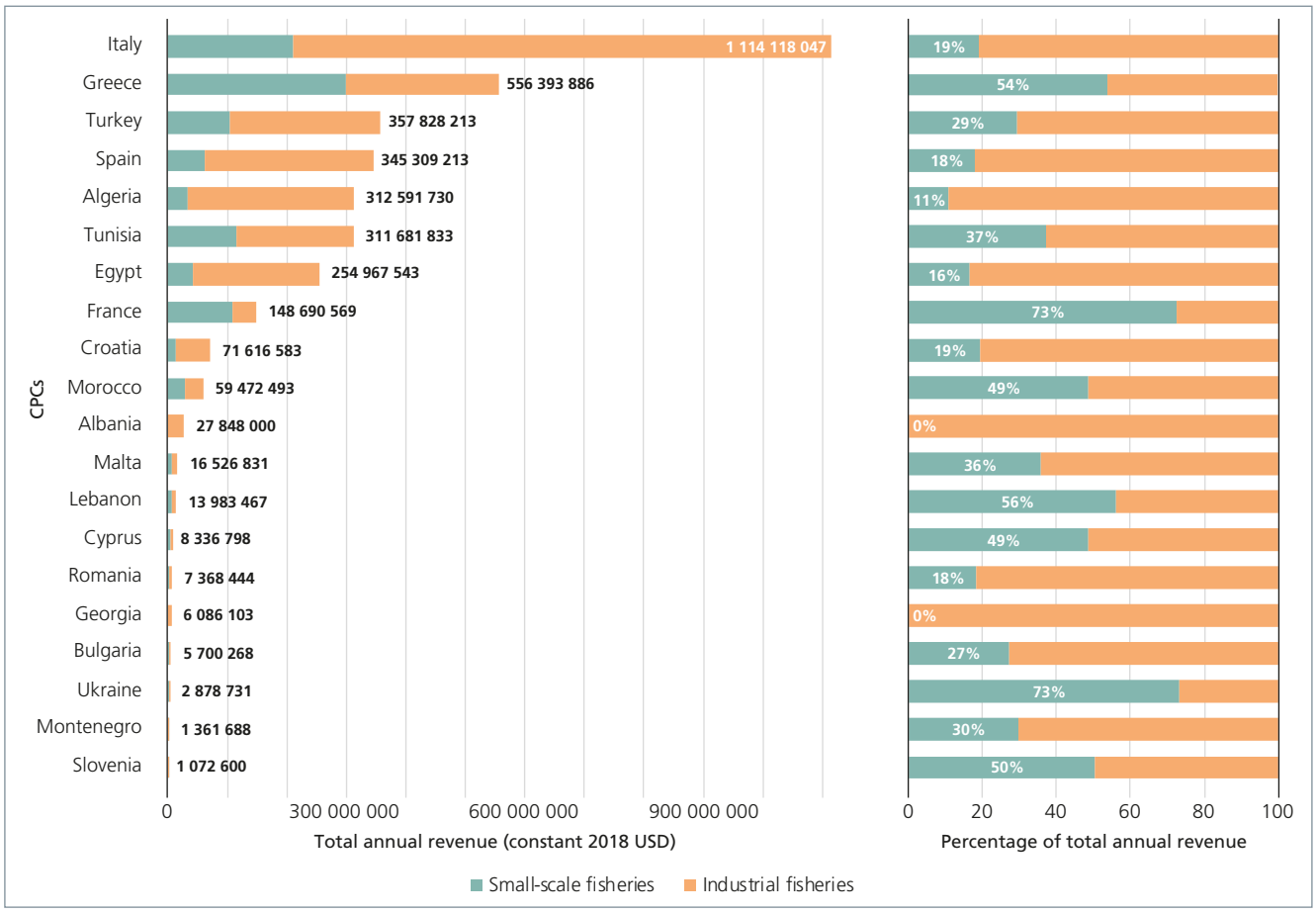


FIGURE 33. Revenue from marine capture fisheries per year by fleet segment group in the GFCM area of application, 2013–2018

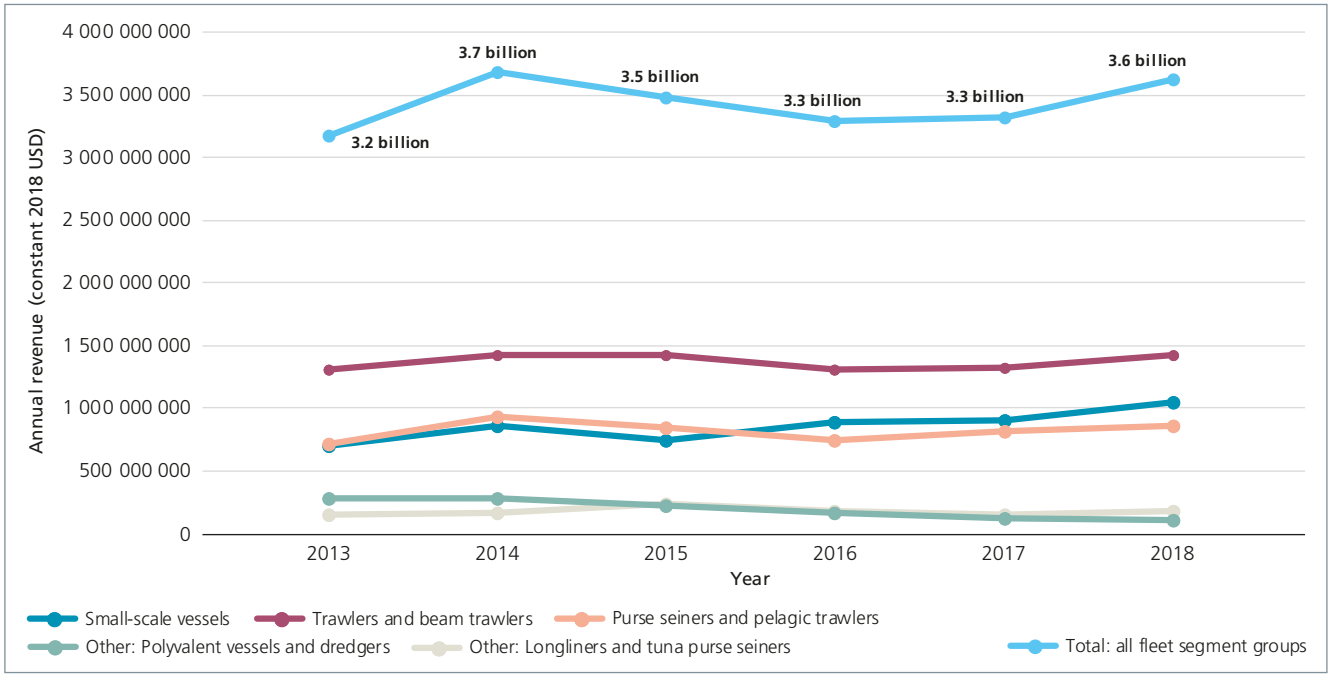
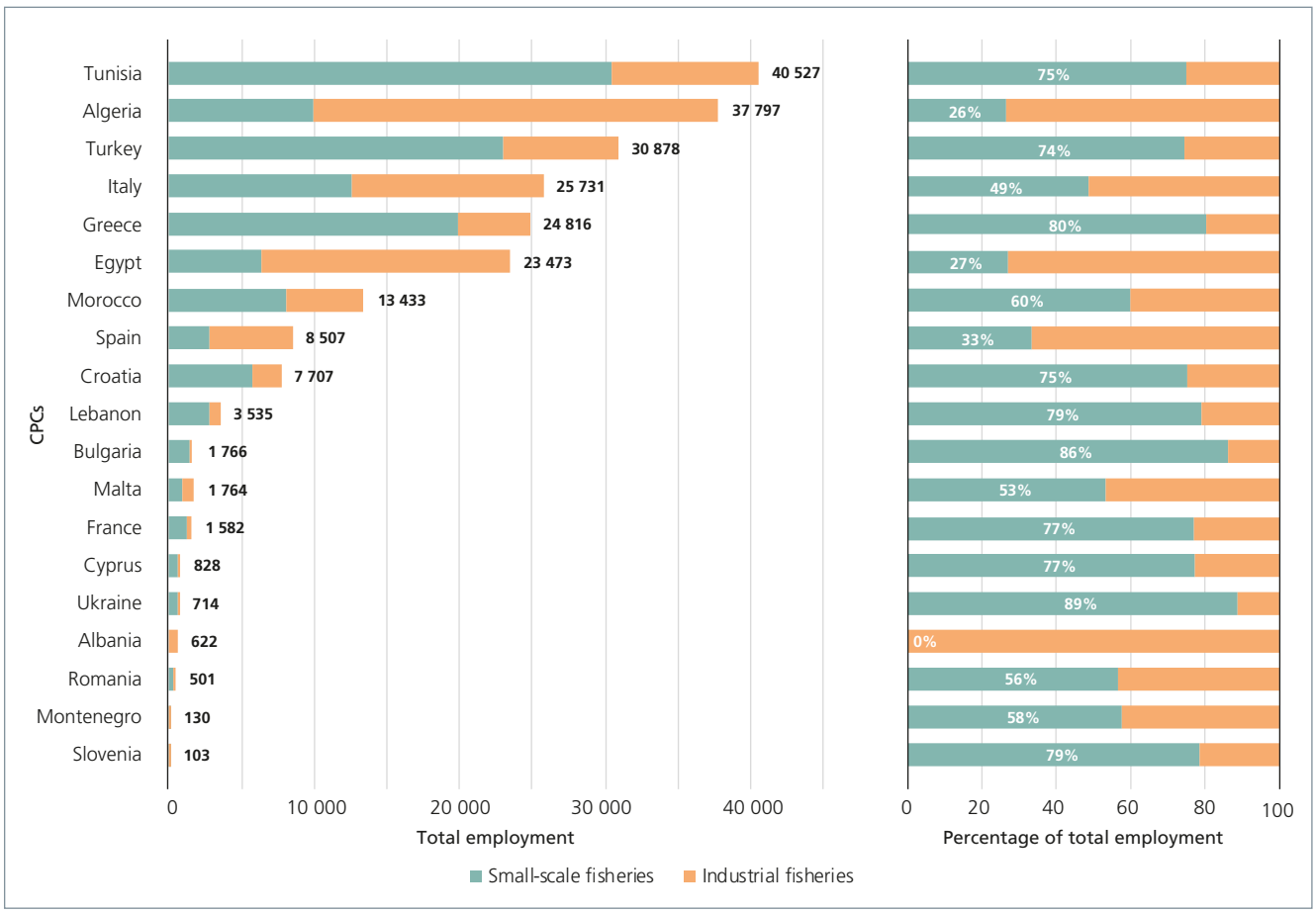


FIGURE 34. Employment onboard small-scale and industrial fishing vessels by GFCM contracting party and cooperating non-contracting party



of Mediterranean and Black Sea Fisheries) (FAO, 2018), revenue has increased by approximately 10 percent. It can be assumed, however, that this increase is at least partially due to more complete and accurate data submissions from all fleet segment groups through the DCRF platform since its introduction in 2016.

Small-scale fisheries contribute 29 percent of the total revenue (29 percent in the Mediterranean and 22 percent in the Black Sea). Considering the revised calculation of the small-scale vessels fleet segment group, this represents an increase of three percent compared with the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018). However, in some countries, including Cyprus, France, Greece, Lebanon, Morocco, Slovenia and Ukraine, the contribution of SSF represents approximately 50 percent or more of total revenue from marine capture fisheries (Figure 32).

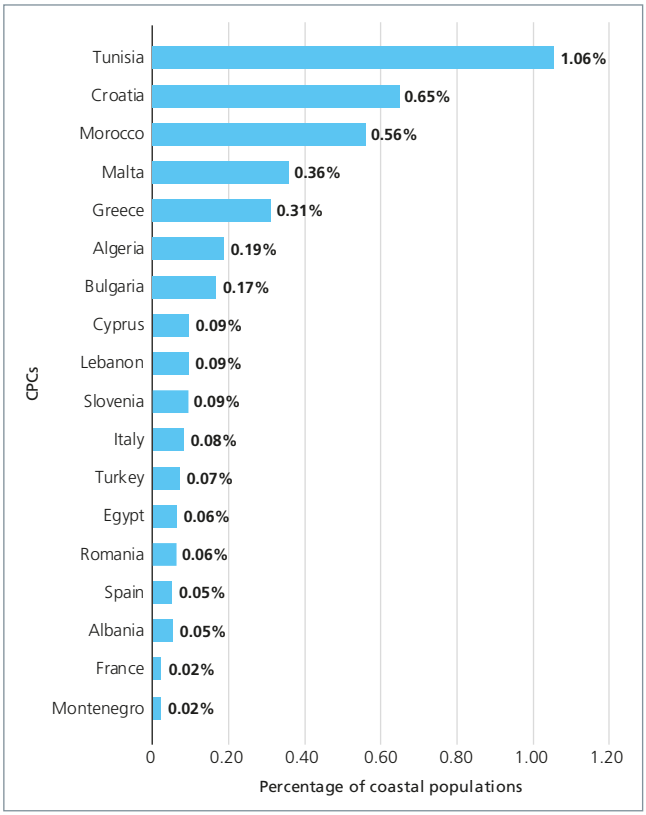
Total employment onboard fishing vessels (part-time and full-time included) in the GFCM area of application[7] is 225 000 (202 000 in the Mediterranean and 23 000 in the Black Sea) (Figure 34). Six countries, namely Tunisia, Algeria, Turkey, Italy, Greece and Egypt account for approximately 82 percent of total employment. Compared to the last comparable figure for reference year 2016 (222 450; FAO, 2018), this value would indicate a relative stagnation, with only a slight increase of about one percent[8].

It is important to note that this employment figure does not account for non-vessel-based employment, such as work done in the pre- and post-harvest sectors and by gleaners and

[7] Excludes Georgia for which data are not available. Includes an estimate of employment on Tunisian vessels below 5 GT (for which a fleet register is not available).

[8] The total employment for reference year 2016 in the *The State of Mediterranean and Black Sea Fisheries 2018* (FAO, 2018) was 248 000 including employment onboard fishing vessels for Libya (2014). In order to compare the change from *The State of Mediterranean and Black Sea Fisheries 2018*, employment for Libya for which data are not available was not considered within the present chapter on socio-economics.

FIGURE 35. Percentage of coastal populations employed onboard fishing vessels by GFCM contracting party and cooperating non-contracting party

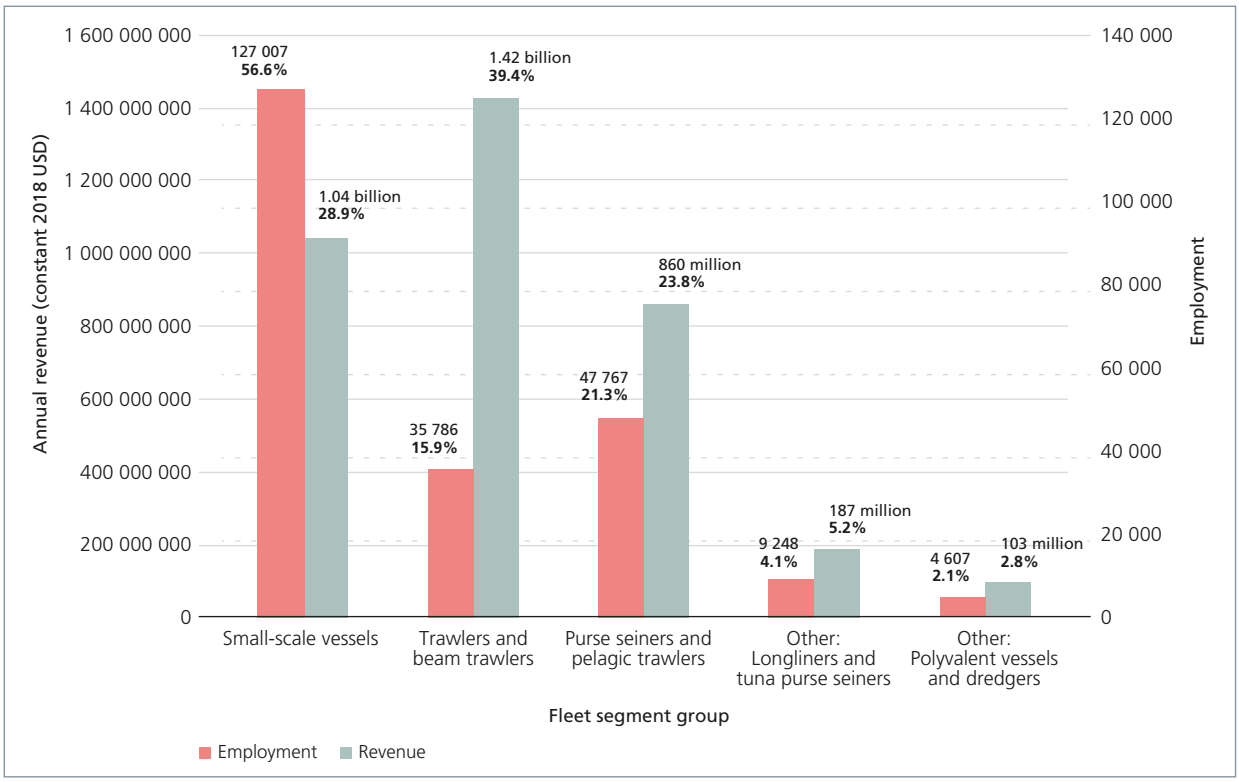


other shore-based activities, as well as the frequently "invisible" work of women (FAO, 2017a; European Commission, 2019). These non-vessel-based jobs are estimated by the World Bank/FAO/WorldFish Hidden Harvest report to employ almost 2.5 times as many people as those onboard vessels (World Bank, 2012), meaning that the total employment in the fisheries sector in the GFCM area of application is estimated to be approximately 785 000 people.

Furthermore, fisheries provide jobs where they are most needed, namely, in rural coastal communities. On average, employment onboard fishing vessels represents approximately 0.1 percent of total coastal populations (i.e. approximately one fisher per every 1 000 coastal residents). However, this number can reach between 0.6 and 1.1 percent (i.e. approximately one fisher per every 95 to 200 coastal residents) in select countries, such as Tunisia, Croatia and Morocco (Figure 35).

At the regional level, SSF contribute to 57 percent of total employment onboard fishing vessels (55 percent in the Mediterranean and 71 percent in the Black Sea). Considering the revised calculation of the small-scale vessels fleet segment group, this value represents

FIGURE 36. Comparison of revenue and employment by fleet segment group in the GFCM area of application



a 4 percent increase from the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018). In some countries, namely Ukraine, Bulgaria, Greece, Lebanon, Slovenia, Cyprus, France, Croatia, Tunisia and Turkey, the contribution of SSF ranges between 70 and 90 percent of total employment (Figure 34).

As shown in Figure 32 and Figure 34, benefits from fisheries are not equally distributed between SSF and industrial fisheries. While employment is fairly evenly split (Figure 34), the two sectors accounting for 57 percent and 43 percent of total employment, respectively, SSF generate only 29 percent of total revenue (Figure 32), significantly less than the 71 percent of revenue generated by industrial fisheries, which is broken down into 39.4 percent from trawlers and beam trawlers, 23.8 percent from purse seiners and pelagic trawlers, 5.2 percent from longliners and tuna purse seiners, and 2.8 percent from polyvalent vessels and dredgers (Figure 36).

At the subregional level, benefits are more evenly distributed (Figure 37), with the western Mediterranean accounting for about 32 percent of employment and 33.4 percent of revenue, followed by the eastern Mediterranean (28.4 percent of employment and 24.1 percent of revenue), the central Mediterranean (21.8 percent of employment and 19.2 percent of revenue), the Adriatic Sea (7.7 percent of employment and 16.5 percent of revenue) and the Black Sea (10.1 percent of employment and 6.8 percent of revenue). The Adriatic Sea is notable as the only subregion where the share of revenue is significantly greater than the share of employment, likely reflective of the lower percentage of small-scale vessels in this subregion (see Figure 9).

SPECIES OF COMMERCIAL IMPORTANCE IN THE GFCM AREA OF APPLICATION

While Mediterranean and Black Sea fisheries are predominantly multi-species fisheries, 22 species represent over 70 percent of the total landing value in the Mediterranean (Figure 38) and just eight represent over 90 percent of the total landing value in the Black Sea (Figure 39). These values account for all CPCs, as a result of improved data submissions through the DCRF Task VI.3. Where Task VI.3 data were not available, it was possible to reconstruct values by applying average prices per species within the subregion to available information on the volume of landings per species from the DCRF Task II.2 or the STATLANT 37A (FAO, 2020d) databases.

The main species of commercial importance vary considerably by fleet segment group and

FIGURE 37. Comparison of revenue and employment by GFCM subregion

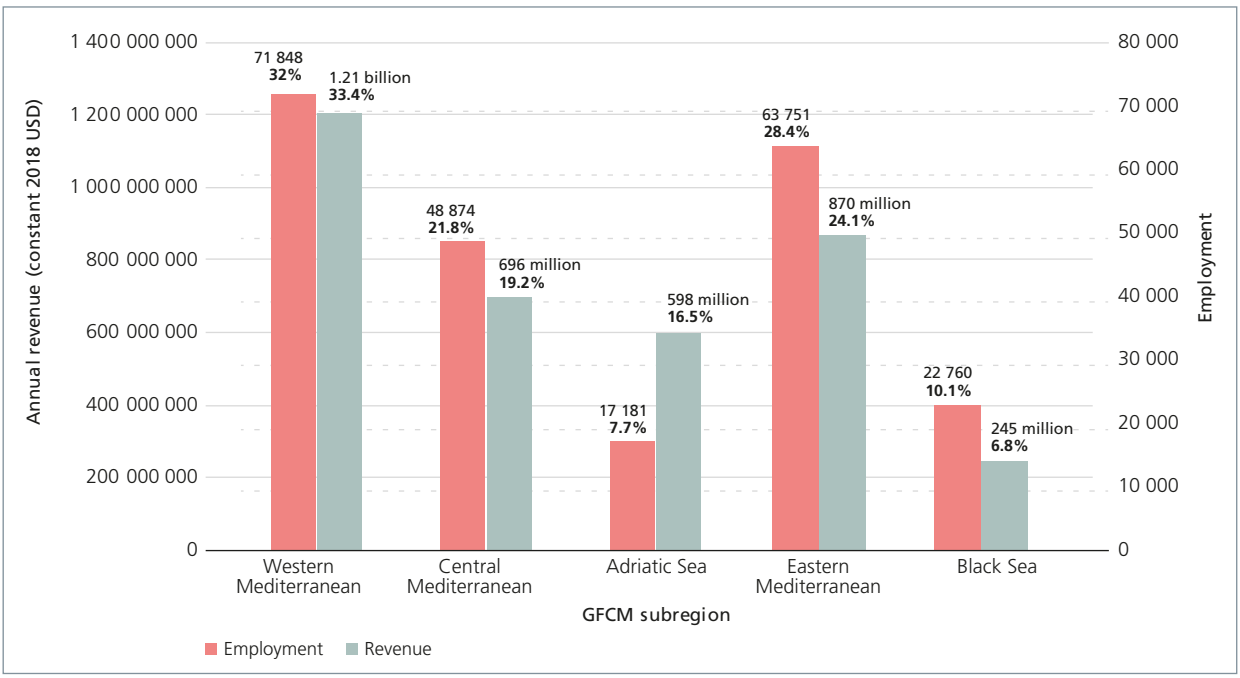
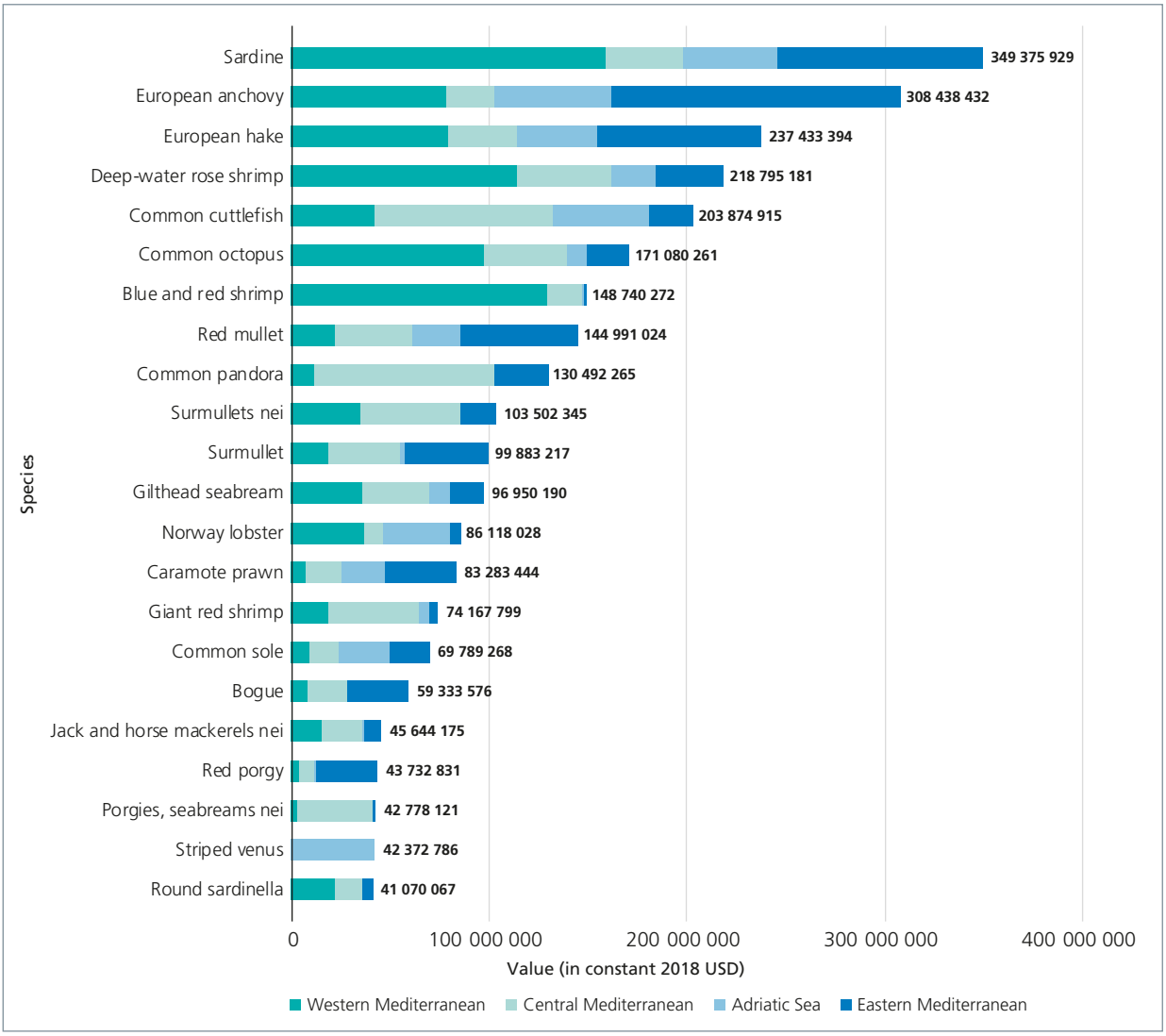


FIGURE 38. Main commercial species (in terms of value) in the GFCM Mediterranean subregions



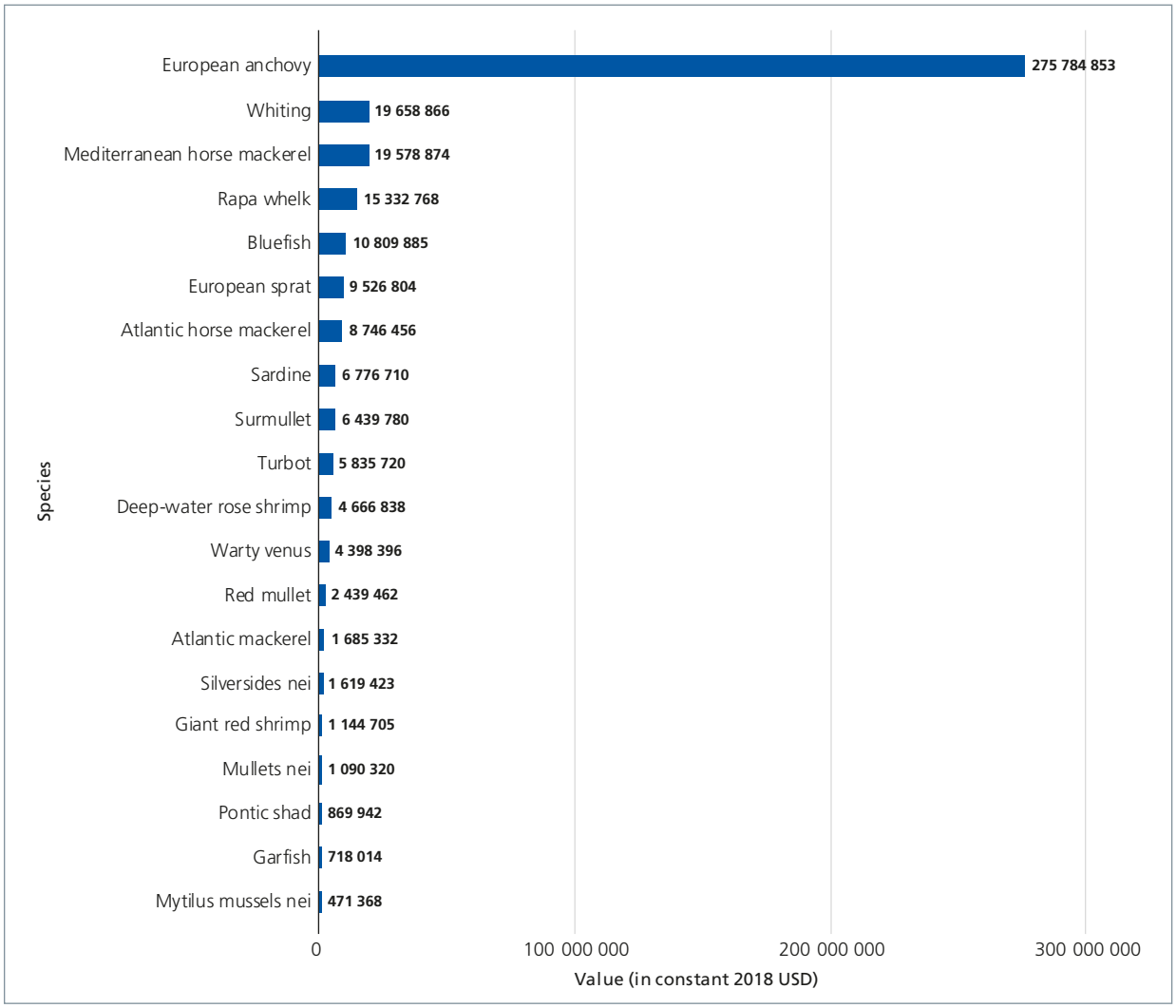
subregion (Figure 40). For example, for SSF, the species of greatest commercial importance by subregion are: the common octopus (*Octopus vulgaris*) in the western Mediterranean, European hake (*Merluccius merluccius*) in the central and eastern Mediterranean, the common cuttlefish (*Sepia officinalis*) in the Adriatic Sea and whiting (*Merlangius merlangus*) in the Black Sea. Considering that SSF represent 57 percent of the total employment onboard fishing vessels in the region (see page 41), these species play a crucial role in supporting livelihoods.

ECONOMIC PERFORMANCE OF THE FISHING FLEET

Revenue

An overview of revenue by fleet segment group and by GFCM subregion was introduced in the regional socio-economic overview at the beginning of this chapter (see page 41), particularly in Figure 36 and Figure 37. However, further analysis of revenue at a subregional and fleet segment level shows that the contribution of each fleet segment group to revenue varies across the different subregions (Figure 41). Trawlers and beam trawlers represent the highest source of revenue in the western Mediterranean (41.4 percent), in the Adriatic Sea (58.3 percent) and in the central Mediterranean (40.4 percent). On the other hand, in the eastern Mediterranean,

FIGURE 39. Main commercial species (in terms of value) in the Black Sea



small-scale vessels represent the highest source of revenue (38.6 percent) and in the Black Sea, purse seiners and pelagic trawlers represent the highest source of revenue (53.1 percent).

Operating costs

Operating costs include the variable and fixed costs necessary to carry out the fishing activity. These costs provide insight into the activity of the vessel and can include: personnel costs (i.e. costs related to remunerating the crew, including social security costs and imputed value of unpaid labour); energy costs (costs of consumed fuel and lubricants for the vessel); repair and maintenance costs (costs for maintenance and repairs of fishing equipment, gear and vessel parts); commercial costs (costs related to sales of vessel outputs, including fish market or wholesaler fees, transportation of products, purchasing of ice, boxes and packaging, etc.); other variable costs (costs of all purchased goods and services related directly or indirectly to fishing effort, such as bait, food consumed during the fishing operation, etc.) and fixed costs (costs not directly connected to the operational activities of the vessel and which remain fixed, regardless of the level of fishing activity in a given year, such as bookkeeping, vessel insurance, legal and/or bank expenses, annual quota for fishers associations, dock expenses, renewal of fishing licenses, etc.).

While the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018) presented a preliminary analysis of the fishing fleet's operating costs based on four countries, since then, full or partial data submissions on operating costs reported through the DCRF platform have improved and information is currently available for 15 CPCs including Albania,

FIGURE 40 . Top five commercial species (in terms of value) by fleet segment group in the GFCM Mediterranean subregions and in the Black Sea

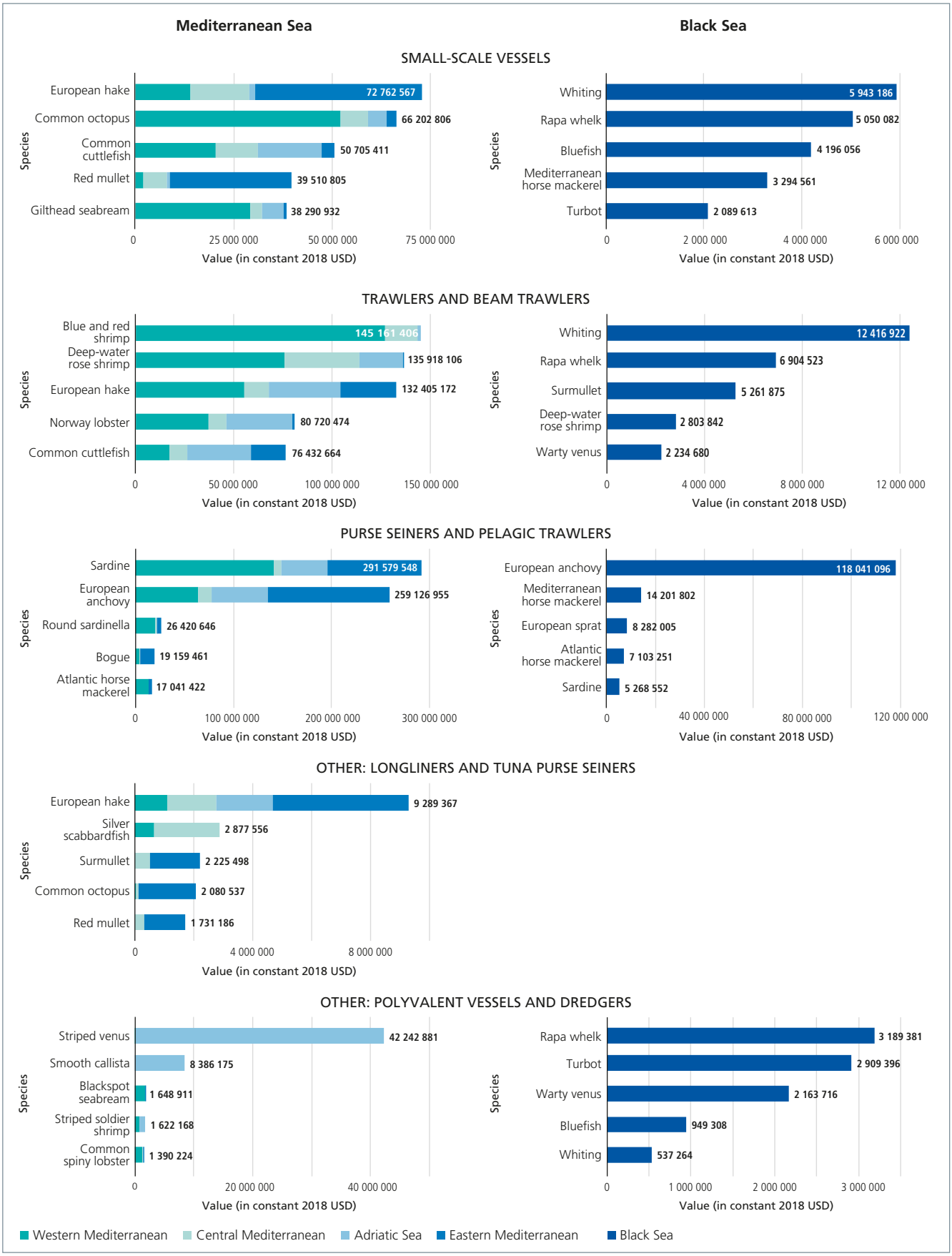
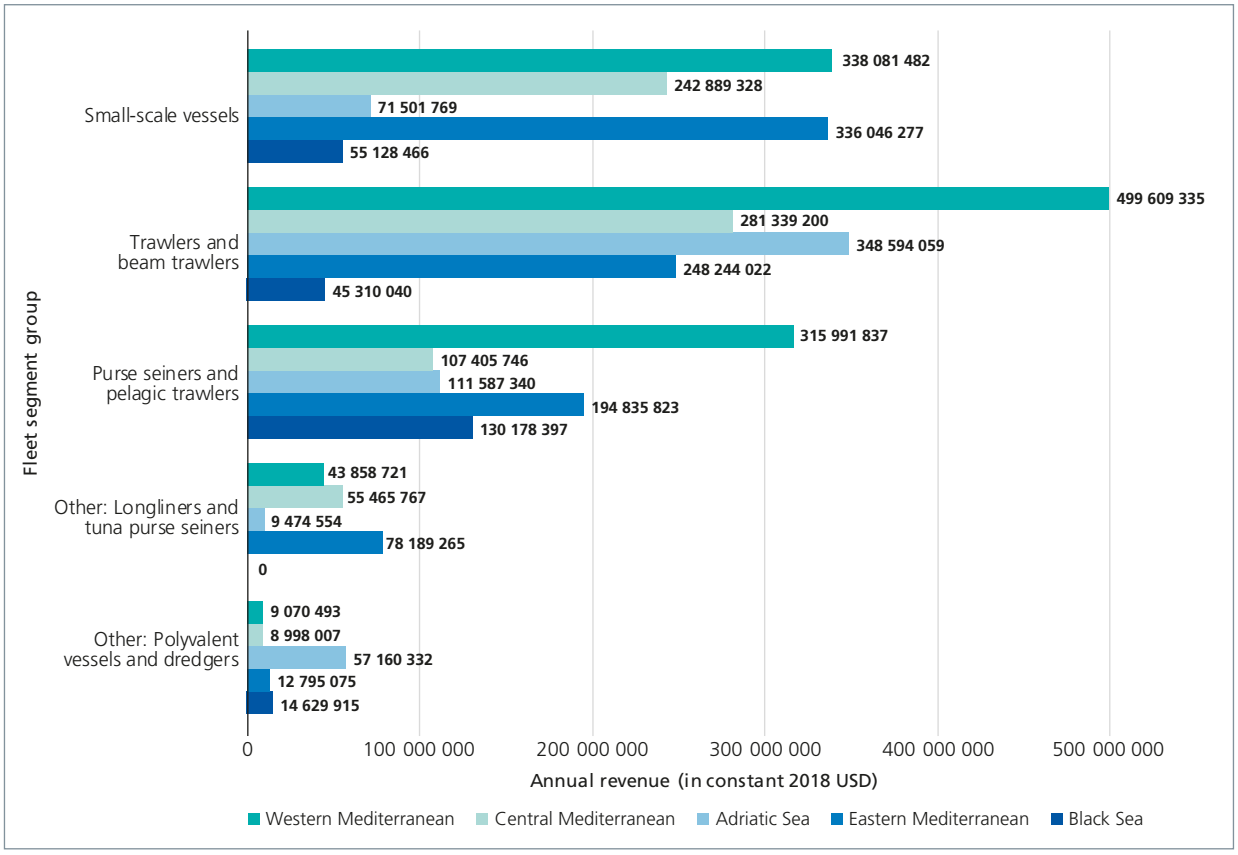


FIGURE 41. Revenue from marine capture fisheries by fleet segment group and GFCM subregion



Box 9. Other sources of income from the use of fishing vessels

While fishing overwhelmingly constitutes the primary source of income for all fishing vessels in the region, the use of fishing vessels for other activities may generate additional income for vessel owners. For example, vessels could be used for tourism or recreational activities (e.g. pescatourism, see definition at page 139), rented for use as support boats for aquaculture activities or by other Blue Economy sectors such as marine extraction industries (e.g. oil, gas, etc.). Income may also be generated by the leasing of quotas or fishing rights. This additional income from vessel use is therefore considered in the calculation of total revenue.

Data on other income from vessel use are optional through the GFCM Data Collection Reference Framework and, therefore, limited data are available. Although still preliminary and based on data from only six GFCM contracting parties (Bulgaria, Croatia, Italy, Malta, Slovenia and Turkey), an analysis of other income from fishing vessels shows that approximately USD 107.6 million is generated from non-fishery uses by the regional fleet, with the majority of other income (55.3 percent) generated by small-scale vessels, followed by trawlers and beam trawlers (37.2 percent). This preliminary analysis suggests the importance of livelihood diversification for small-scale fisheries through alternative uses of vessels for pescatourism and other activities, which is promoted by the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (GFCM, 2018b).

Other income from vessel use by fleet segment group

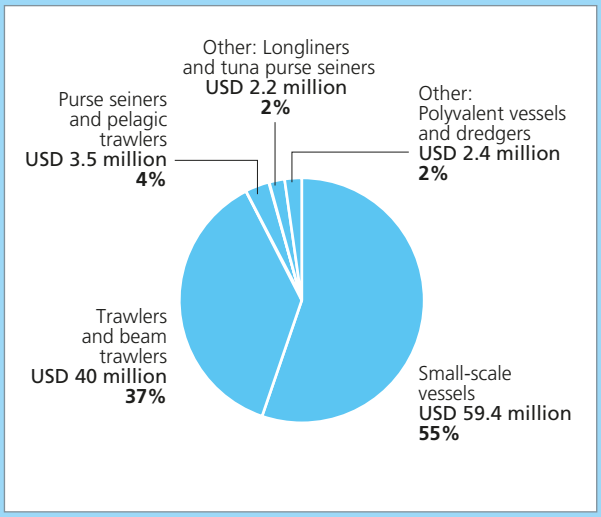
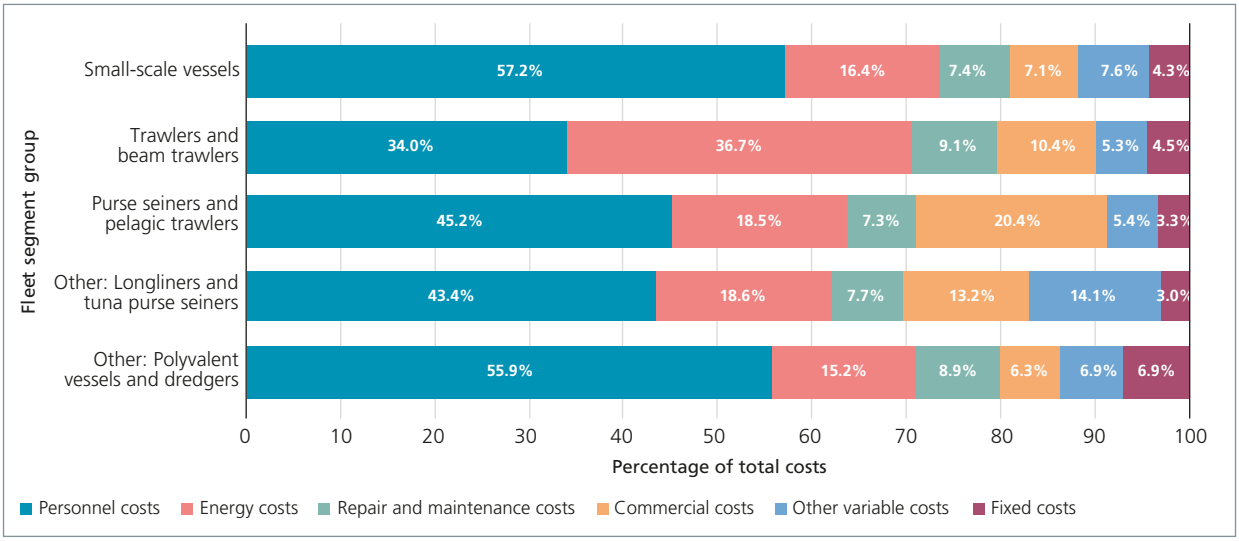


FIGURE 42. Operating cost structure (as a percentage of the total costs) by fleet segment group



Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Italy, Lebanon, Malta, Romania, Slovenia, Tunisia and Turkey, allowing for further analysis of cost structures.

For this group of CPCs, personnel costs and energy costs represent the most significant portion of operating costs, accounting for 45.2 percent and 24.7 percent of total costs, respectively. However, the importance of personnel and energy costs varies at the fleet segment group level (Figure 42). For example, personnel costs reach as high as 57.2 percent of total costs for small-scale vessels, while energy costs represent only 16.4 percent of total costs. On the other hand, for trawlers and beam trawlers, energy costs are relatively high, accounting for 36.5 percent of all operating costs, while personnel costs are relatively lower, representing only 34 percent of all operating costs.

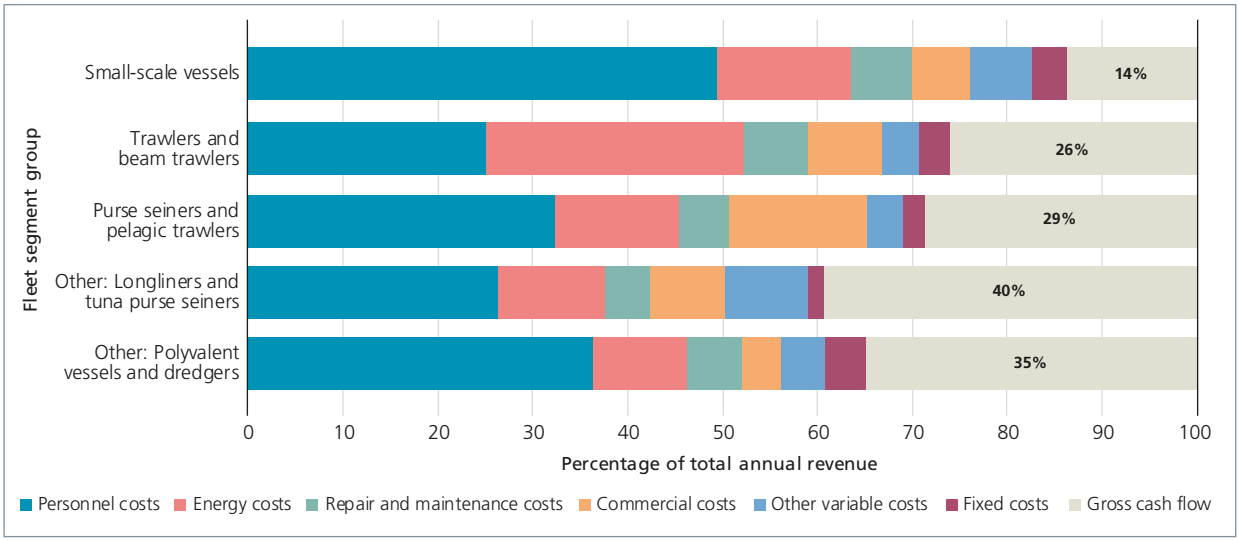
Similarly, commercial costs are relatively more important for purse seiners and pelagic trawlers (20.4 percent of total operating costs) than for small-scale vessels (7.1 percent of total operating costs), indicating perhaps a more complex value chain for the former and a shorter, more direct value chain for the latter (see page 57). Commercial costs are particularly significant for purse seiners and pelagic trawlers in select GFCM subregions, representing up to 15.3 percent of total operating costs in the eastern Mediterranean and 20.5 percent of total operating costs in the Black Sea.

Box 10. Impact of fuel costs on revenue from fisheries

The impact of fuel costs on revenue – measured as the ratio of fuel costs to revenue – provides useful indications for fisheries management. A lower ratio indicates that fuel has a lesser impact on revenue, and that fuel costs are therefore being spent more efficiently. This ratio is influenced by a number of factors, including the type of fishing operation and gear used and the status of fishery resources. The impact of fuel costs on revenue has been calculated for the group of GFCM contracting parties that were considered in the estimation of gross value added (see page 51); these include Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Italy, Lebanon, Malta, Romania, Slovenia, Tunisia and Turkey.

On average, for all fleet segment groups in these countries, the impact of fuel costs on revenue is estimated at approximately 18.7 percent of revenue (meaning that for every dollar of revenue, USD 0.19 is spent on fuel). In general, the impact of fuel costs on revenue tends to be lower for SSF than for industrial fisheries, averaging 14.1 percent for small-scale fisheries (SSF) (meaning that USD 0.14 is spent on fuel in order to earn USD 1 in revenue) and 20.7 percent for industrial fisheries (meaning that USD 0.21 is spent on fuel in order to earn USD 1 in revenue). In the western Mediterranean and the central Mediterranean, fuel costs have an even lower impact on SSF revenue, with indicators of 8.1 percent and 8.8 percent, respectively. Across the fleet segment groups, fuel costs have the highest impact on revenue for trawlers and beam trawlers, around 22 percent in both the western and eastern Mediterranean and varying between 25.6 and 28.8 percent across the other GFCM subregions.

FIGURE 43. Gross cash flow and operating cost structure (as a percentage of the total annual revenue) by fleet segment group



Profitability and wealth generation

Consideration of revenue and operating costs together provides insight into the profitability of the sector and the wealth generated by fishing activities. In this respect, two indicators are useful: gross cash flow and gross value added (GVA). This section presents analyses of these indicators based on data fully or partially submitted by a group of 13 CPCs , which includes Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Italy, Lebanon, Malta, Romania, Slovenia, Tunisia and Turkey.

The first indicator, gross cash flow, represents the total amount of cash generated each year by the fishing activity and gives an appreciation of profitability. It can be considered as the main indicator for assessing the feasibility of the survival of the fishing activity over the short term and is calculated as revenue minus operating costs. The gross cash flow for all fleet segment groups is positive, representing on average 24 percent of revenue, indicating that the revenues from landings were greater than the total gross costs and that, on average, the fishing fleet in the region is profitable.

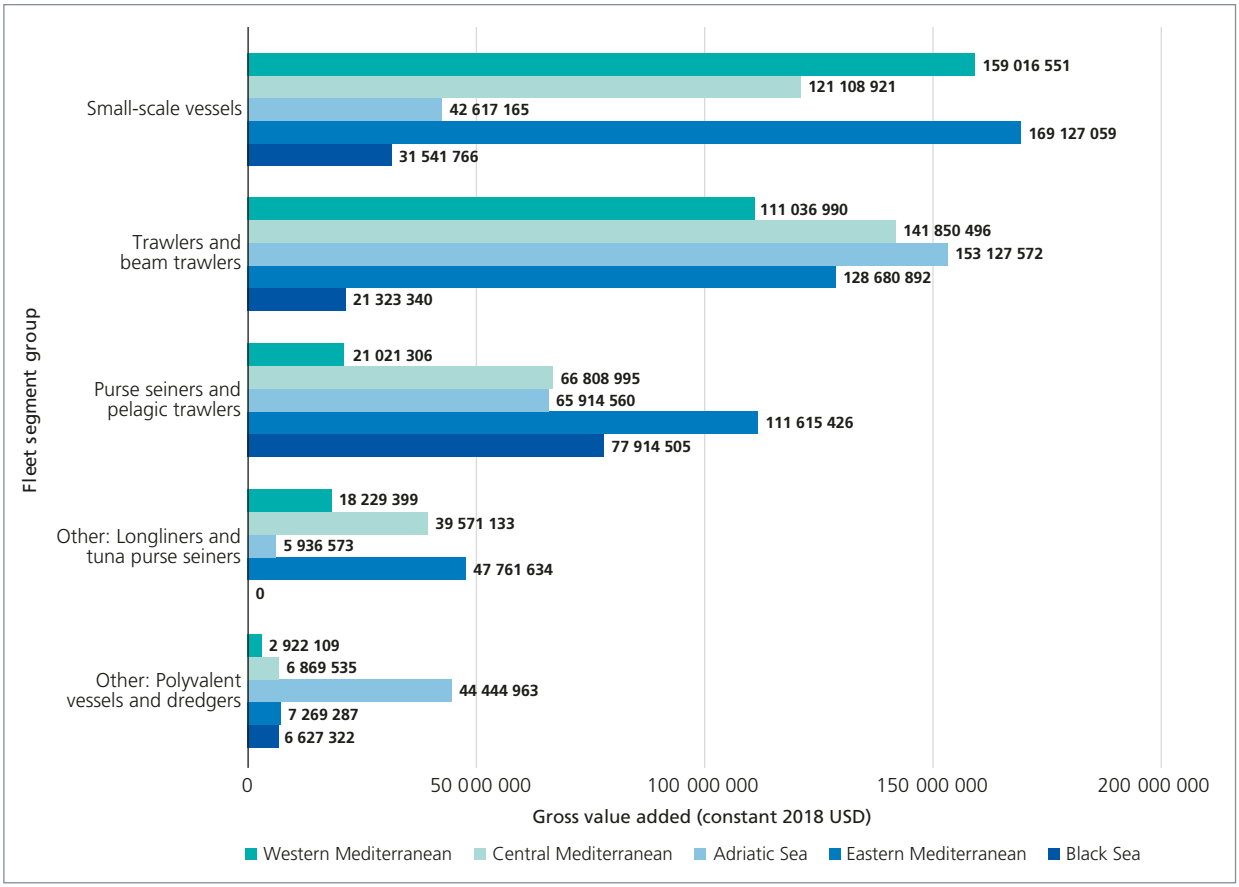
However, gross cash flow varies widely by fleet segment group, representing only 13.6 percent of revenue for small-scale vessels, as opposed to 28.5 percent of revenue, on average, for the industrial fleet segment groups (Figure 43). The low profit margins (i.e. gross cash flow) of SSF show the small-scale sector's shortage of cash on hand to invest in itself (e.g. for gear or marketing improvements), as well as its limited financial resilience in the face of unforeseen shocks (e.g. the COVID-19 pandemic).

However, gross cash flow does not fully capture the total amount of wealth generated each year by the fishing activity. A second indicator, GVA, which is calculated as revenue minus all operating costs excluding personnel costs, is a better indicator of economic welfare (i.e. wealth created) since it considers personnel costs (i.e. salaries) not as a cost (as in the case of gross cash flow), but as a positive contribution to the economy. In this sense, GVA measures the contribution to gross domestic product by the fishing activity.

Available data from the 13 CPCs mentioned at the beginning of this section (which represent a total revenue of USD 2.7 billion, or about three quarters of the total revenue from fishing in the region) were analysed and the total GVA from fishing in these CPCs has been calculated at USD 1.6 billion, putting the GVA (for all fleet segment groups considered in the calculation) as a percentage of revenue in this selected group of countries at around 58.5 percent.

In terms of the percentage of total GVA obtained from fishing by each fleet segment group, trawlers and beam trawlers represent 34.7 percent; small-scale vessels represent 32.7 percent; purse seiners and pelagic trawlers represent 21.4 percent; longliners and tuna purse seiners represent 7.0 percent; and polyvalent vessels and dredgers represent 4.3 percent.

FIGURE 44. Gross value added by fleet segment group and GFCM subregion



The fact that the GVA of small-scale vessels is second only to trawlers and beam trawlers underlines that, while SSF may experience limited profit margins (and therefore limited capacity to invest in itself), this fleet segment group is nevertheless an important generator of wealth for the fishing sector.

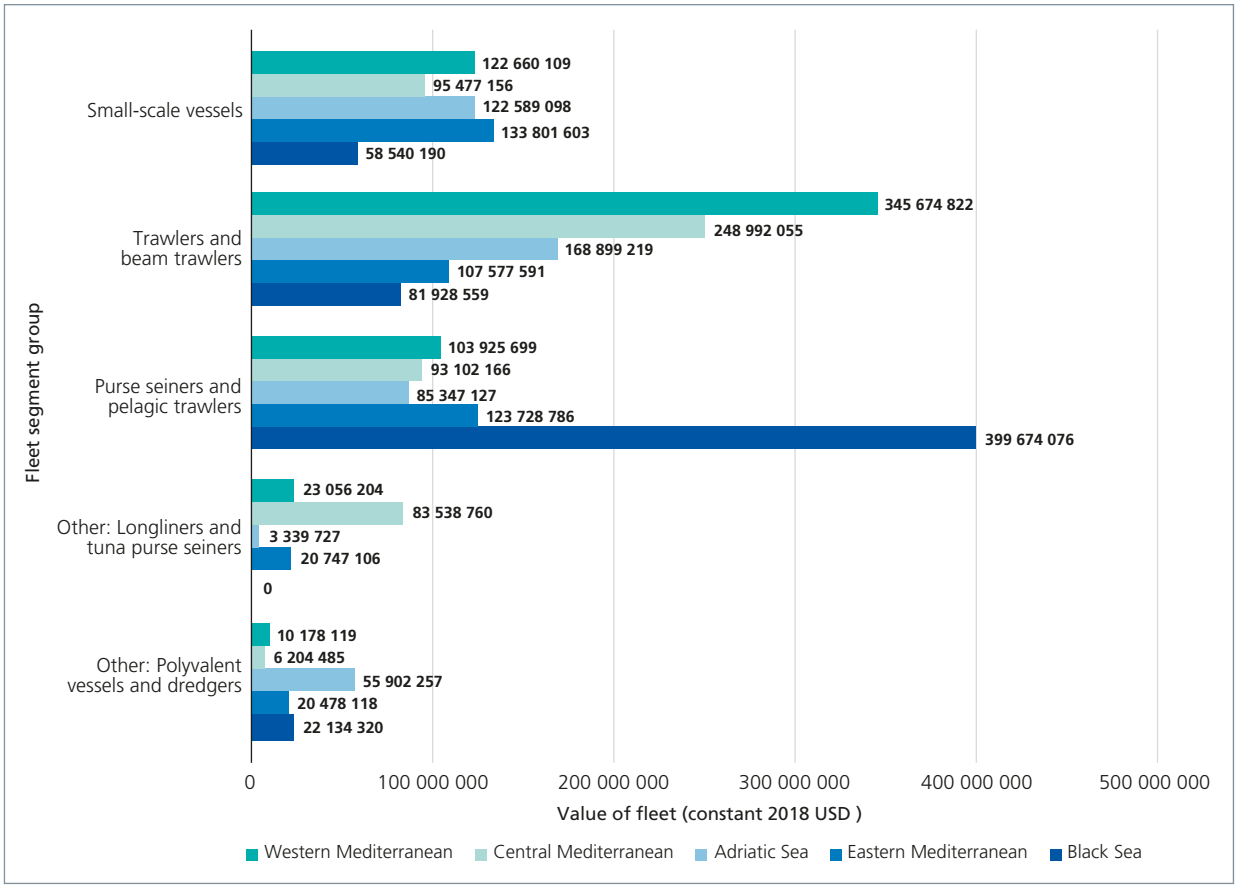
The contribution of each fleet segment group to GVA varies across the different GFCM subregions (Figure 44). Trawlers and beam trawlers represent the main contributor to GVA in the Adriatic Sea (49.1 percent of total GVA from fishing in the subregion) and the central Mediterranean (37.7 percent), whereas small-scale vessels represent the main contributor to GVA in the western Mediterranean (50.9 percent of total GVA from fishing in the subregion) and the eastern Mediterranean (36.4 percent), and the second highest contributor to GVA in the central Mediterranean (32.2 percent). Purse seiners and pelagic trawlers represent the main contributor to GVA only in the Black Sea (56.7 percent of total GVA from fishing in the subregion). These values closely correlate with revenue by fleet segment group and subregion (see Figure 41).

A more in-depth analysis of the wealth generated by fishing activities (i.e. GVA) should also take into account the operating subsidies (e.g. the amount of direct monetary subsidies) received by fishing vessel owners from the government, either to support the fishing activity or to facilitate investments. While an analysis of subsidies in relation to GVA is limited by a lack of data (data has been partially provided by only eight of the 13 CPCs concerned), a preliminary analysis provides indications of the sector's reliance on subsidies. Overall, subsidies represent 2.7 percent of GVA for all fleet segment groups. They are highest for trawlers and beam trawlers (4.5 percent) and for purse seiners and pelagic trawlers (2.5 percent) and below average for small-scale vessels (1.7 percent).

Physical capital (fleet value)

Physical capital (i.e. the value of the fleet, including the vessel hulls, engines, onboard equipment and gear) is one of the basic

FIGURE 45. Fleet value by fleet segment group and GFCM subregion



indicators of fishing capacity. Data on physical capital used in this chapter are preliminary (only 15 CPCs reporting fully or partially, including Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Italy, Lebanon, Malta, Montenegro, Romania, Slovenia, Tunisia and Turkey). The value of fishing fleets (all segments included) for this group of CPCs is USD 2.5 billion, with trawlers and beam trawlers representing 37.6 percent of this total value, purse seiners and pelagic trawlers representing 31.8 percent and small-scale vessels representing 21 percent.

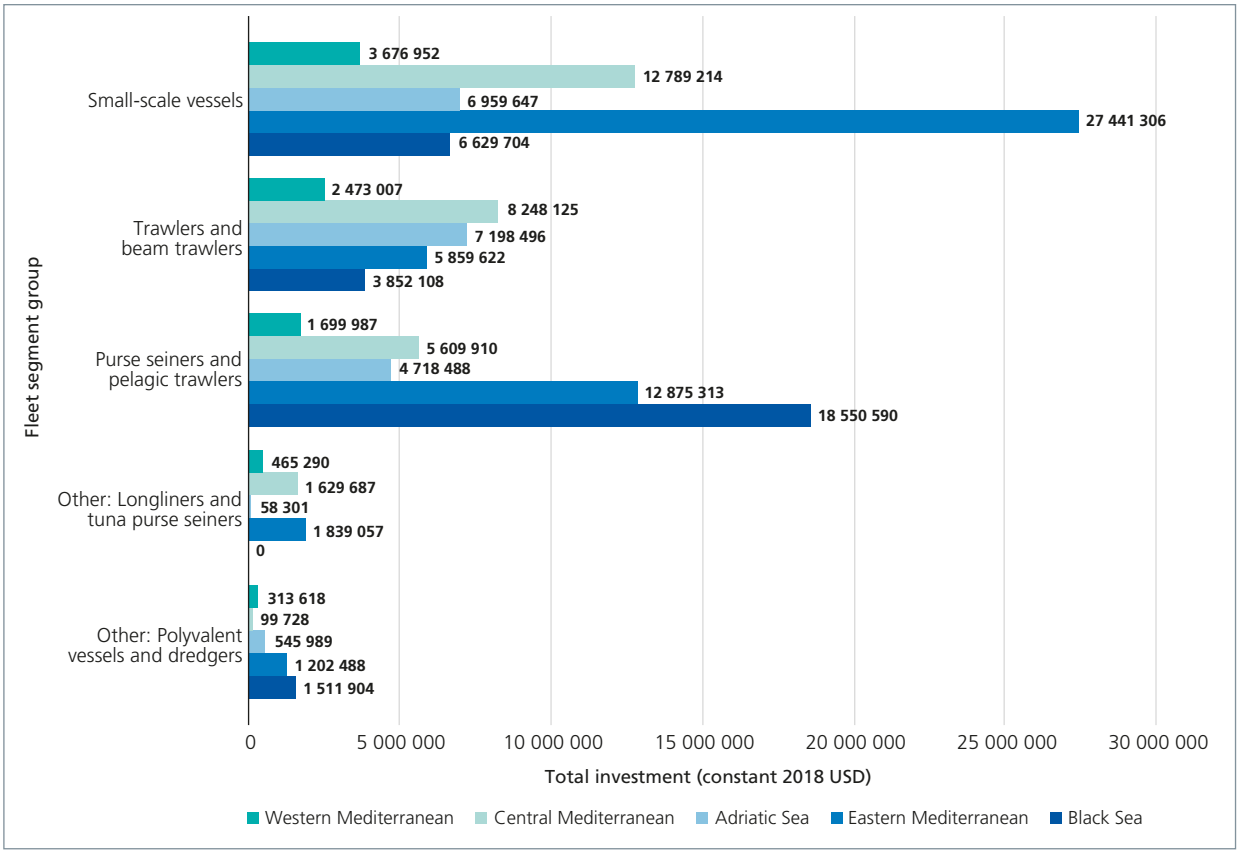
However, across the region, the relative contributions of the different fleet segment groups to physical capital varies significantly (Figure 45). Of particular note is the high value of trawlers and beam trawlers in the western Mediterranean (representing 57.1 percent of the entire value of the subregional fleet) and the high value of purse seiners and pelagic trawlers in the Black Sea (representing 71.1 percent of the entire value of the subregional fleet).

Annual investments

Annual investments are one of the indicators used to measure economic dynamics in the fisheries sector. Data are preliminary, with only 15 CPCs reporting fully or partially, including Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Italy, Lebanon, Malta, Montenegro, Romania, Slovenia, Tunisia and Turkey. Total annual investments are around USD 136.2 million, with 42.2 percent of the value of all investments in the region going to small-scale vessels, whereas 31.9 percent go to purse seiners and pelagic trawlers and 20.3 percent to trawlers and beam trawlers.

Across the region, investments vary significantly between fleet segment groups (Figure 46). The high value of investment in purse seiners and pelagic trawlers in the Black Sea, for example, (60.7 percent of all investments in the subregion) is consistent with the high value of this fleet in this subregion (Figure 45). The high value of investment in small-scale vessels in the eastern Mediterranean (55.8 percent of all investments in the

FIGURE 46. Total annual investments in physical capital by fleet segment group and GFCM subregion



subregion), on the other hand, may reflect more precise data collection resulting from the socio-economic survey carried out there.

THE CONTRIBUTION OF FISHERIES TO LIVELIHOODS

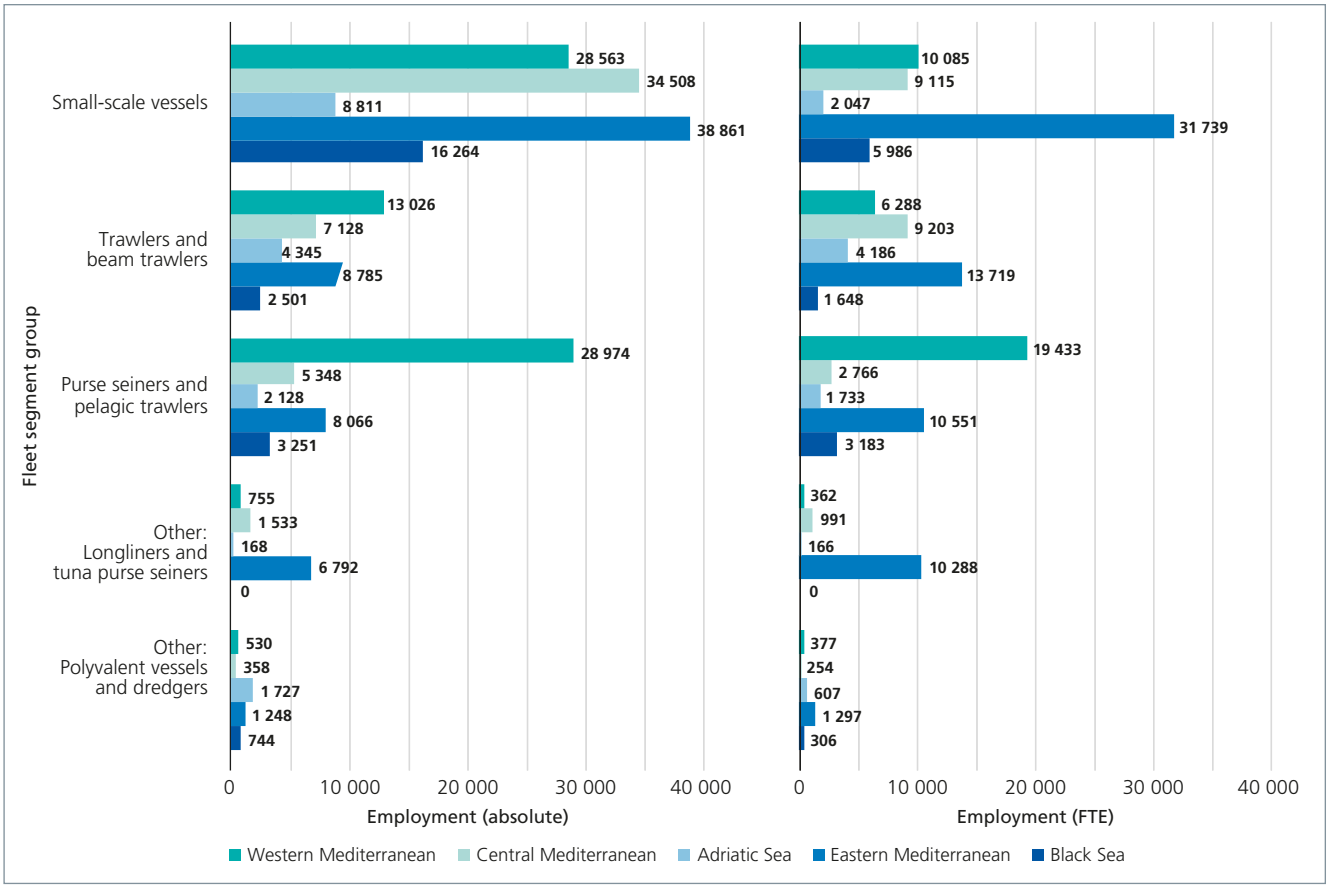
Employment

As shown in Figure 36 and Figure 37, employment onboard fishing vessels varies across subregions and fleet segment groups. A further look at employment (Figure 47) shows that, at a regional level, small-scale vessels generate the highest number of (absolute) on-vessel jobs (56.6 percent of total employment), followed by purse seiners and pelagic trawlers (21.3 percent), and trawlers and beam trawlers (15.9 percent).

The importance of each fleet segment group in terms of absolute employment, however, varies significantly across subregions. For example, in the western Mediterranean, purse seiners and pelagic trawlers and small-scale vessels employ the highest number of people: 40.3 percent and 39.8 percent, respectively, of employment in the subregion. In the eastern Mediterranean, the Black Sea and the central Mediterranean, small-scale vessels contribut 61 percent, 71.5 percent and 70.6 percent respectively. In the Adriatic Sea, small-scale vessels, followed by trawlers and beam trawlers, employ the highest number of people, accounting for 51.3 percent and 25.3 percent, respectively, of employment in the subregion.

The absolute employment data here indicated take into account the number of workers employed onboard vessels, including those working on a part-time basis (who may supplement their income, in some cases, with other part-time employment in other sectors; see Box 11). To facilitate the comparison of workloads across subregions and fleet segment groups, full time equivalent (FTE) employment can be a useful indicator. Full-time equivalent employment equals the number of full-time equivalent jobs and is calculated as total hours worked divided by the average annual number of hours worked in a full-time job. The commonly used international threshold for full-time employment in fishing is 2 000 hours per year; labour input below this threshold is considered as part-time.

FIGURE 47. Employment by fleet segment group and GFCM subregion



Although full or partial data submissions on FTE reported through the DCRF platform have improved in recent years, the fact remains that not all CPCs report both absolute and FTE employment. As a result, the information available to calculate employment in terms of FTE represents about 86 percent of the information that is available on employment in absolute terms. In FTE terms, the contribution of each fleet segment group to total employment is more evenly distributed (Figure 47). Small-scale vessels still generate the highest number of jobs, but to a lesser extent (40.3 percent of FTE employment), owing to the fact that many small-scale fishers are employed on a part-time basis. On the other hand, the contributions of purse seiners and pelagic trawlers and of trawlers and beam trawlers are respectively 25.7 percent and 23.9 percent of total onboard vessel employment. It is important to recognize, however, that FTE does not fully capture SSF work, as it only considers time at sea, whereas a significant part of SSF work is shore-based.

Across the region, the importance of each fleet segment group, in terms of FTE, also varies significantly. For example, in the western Mediterranean, the fleet segment group employing the highest number of people in terms of FTE are purse seiners and pelagic trawlers (53.2 percent of FTE employment in the subregion). In the Adriatic Sea, trawlers and beam trawlers employ the highest number of people in terms of FTE (47.9 percent of FTE employment in the subregion). In all other subregions, small-scale vessels employ the highest number of people in terms of FTE, with the following proportions: 40.8 percent in the central Mediterranean, 47 percent in the eastern Mediterranean and 53.8 percent in the Black Sea.

Furthermore, the nature of the work carried out onboard, as well as the number of people working onboard a vessel at a given time, differ by fleet segment group. As illustrated by Figure 48, in those CPCs for which employment data are available, each small-scale vessel employs, on average, two fishers, whereas the average trawler or beam trawler employs approximately six fishers and the average purse seiner or pelagic trawler employs approximately 12 fishers.

FIGURE 48 Average number of employees per vessel by fleet segment group

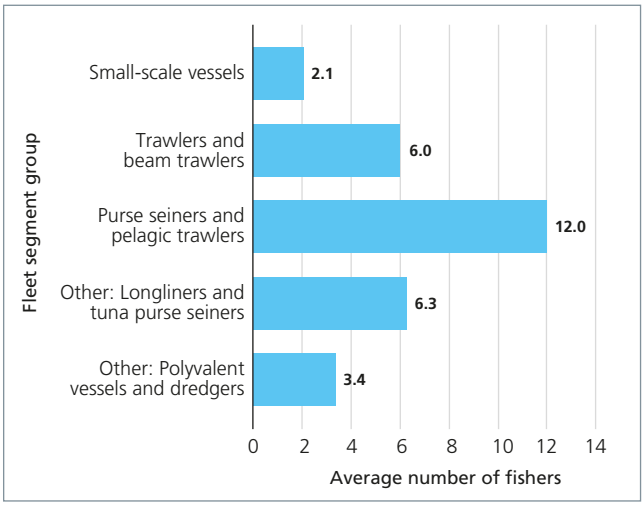
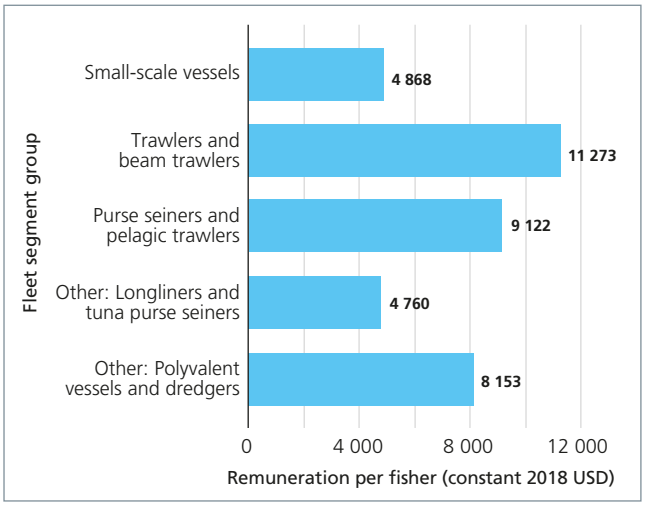


FIGURE 49. Annual remuneration per fisher (in absolute terms) by fleet segment group



Remuneration per fisher

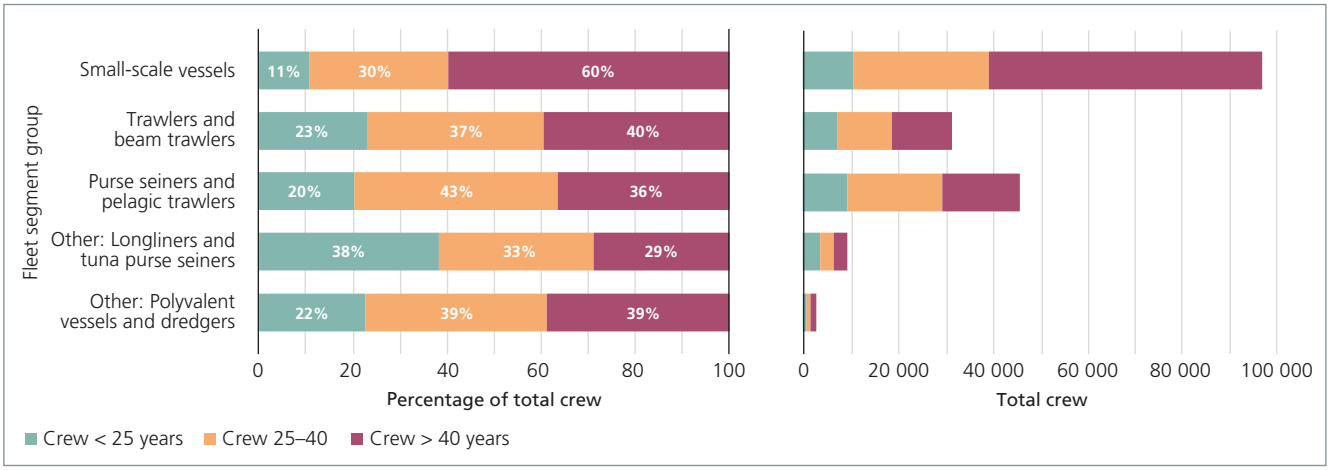
Remuneration is the main measure of the fishing sector's contribution to the livelihoods of fishers. It can include both cash and in-kind payments (e.g. a share of the catch for self-consumption) and can either be fixed or in proportion to the fishing vessel's profit (revenue minus certain operating costs). Remuneration per fisher, which in the present section only considers cash payments (thereby excluding in-kind payments), is calculated by dividing total personnel costs by the number of fishers. The analysis presented in this section is based on data fully or partially submitted by a group of 13 CPCs including Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Italy, Lebanon, Malta, Romania, Slovenia, Tunisia and Turkey.

Annual remuneration per fisher (absolute employment) is, on average, around USD 6 671 in the GFCM area of application. Fishers in the two main industrial fleet segment groups – trawlers and beam trawlers, and purse seiners and pelagic trawlers – earn annually, on average, USD 11 273 and USD 9 122 respectively, almost double the annual remuneration per small-scale fisher (Figure 49).

Demographic characteristics

For insight into the demographic patterns of employment in the fishing sector in the GFCM area of application, the DCRF requests information on the age distribution of fishers (optional under Task VI-4). Information on the age distribution of on-vessel employment is

FIGURE 50. Age distribution of crew by fleet segment group



available, at least partly, for 13 CPCs including Albania, Algeria, Bulgaria, Croatia, Egypt, Greece, Lebanon, Malta, Morocco, Romania, Slovenia, Tunisia and Turkey. For this group of CPCs, on average, 17 percent of the crew is less than 25 years old, 35 percent is between 25 and 40 years old, and 49 percent is over 40 years old, revealing that the fisheries in the GFCM area of application have a relatively older workforce.

The age distribution also varies by fleet segment group. For example, while the majority of fishers (60 percent) working on small-scale vessels are over the age of 40, this fleet segment group still employs a higher total number of young people than any other fleet segment group (Figure 50). To secure a future for the fishing sector, particularly for SSF, efforts are needed to support the generational turnover of the sector (see Chapter 6, page 108).

VALUE CHAIN

A value chain is "the full range of activities which are required to bring a product or service from conception, through the different phases of production, transformation and delivery to final consumers, and eventual disposal after use" (Naji, 2015). Improving the understanding of the distribution of benefits along the value chain will provide insight into the dynamics that may affect fisher behaviour and thus fisheries management.

Commercialization of the catch

Other than information on the value at first sale and commercial costs (see Chapter 3, page 46), data transmitted through the DCRF provide limited insight into the commercialization of the catch from Mediterranean and Black Sea fisheries. With a view to improving knowledge of fisheries value chains in the region, the GFCM

Box 11. Other social characteristics of the fishing sector

The first meeting of the Working Group on Small-Scale Fisheries (GFCM, 2017) highlighted the need for more insight into the social characteristics of the region's fisheries sector, particularly the small-scale fisheries (SSF) sector. Emerging from the conclusions of this working group, the GFCM socio-economic survey endeavoured to collect (whenever participating countries agreed) information on the social characteristics of fisheries, beyond what is collected through the GFCM Data Collection Reference Framework. The estimates provided in the present box are derived from the results of socio-economic surveys conducted in Algeria, Egypt, Lebanon, Tunisia and Turkey. For further information on the characterization of the SSF sector, see Chapter 6, page 99.

Engagement of vessel owners in the activity of their vessels

Analysis of vessel ownership shows that small-scale vessel owners are more commonly engaged in the onboard activities of their vessels (87.3 percent of small-scale vessel owners) than the owners of vessels in the industrial fleet segment groups (58.8 percent on average). On the other hand, the proportion of owners engaged in the activity of vessels onshore (including vessel cleaning and maintenance, net repair, preparing landings for sale, etc.) is quite similar between the owners of small-scale vessels (76.5 per cent) and the owners of vessels belonging to the industrial fleet segment groups (66.2 percent).

Alternative employment

Pluriactivity (i.e. practicing two or more different professional activities) is common in the fishing sector. For example, many fishers may also engage in agricultural work or work in the manufacturing or tourism sectors as well. The socio-economic survey asked vessel owners about their engagement in other professional activities and found that pluriactivity is more pronounced for SSF vessel owners (34.7 percent of small-scale vessel owners are also engaged in professional activities outside the fishing sector) than for owners of vessels belonging to the industrial fleet segment groups (17.2 percent of vessel owners). Moreover, of these pluriactive vessel owners, fishing is the main income generator for only 20.5 percent of the small-scale vessel owners, as opposed to 40.1 percent of the owners of vessels belonging to the industrial fleet.

Gender

In general, at a regional level, onboard activities are carried out almost entirely by men: men make up 99.6 percent of small-scale vessel owners and 97.7 percent of industrial vessel owners; 99.9 percent of skippers on small-scale vessels and 100 percent of skippers on industrial vessels; and 99.7 percent of small-scale vessel crew members and 100 percent of industrial vessel crew members. It is important to note that the socio-economic survey analysed only vessel-based fishing activities. As such, these figures do not capture non-vessel-based fisheries activities (e.g. pre- and post-harvest activities, and shore-based fishing), where women typically play a more important role.

socio-economic survey (see Box 8) collected data on the percentage of landings sold commercially, as well as on the specific destination of landings (when agreed by the country to be included within the questionnaire). The data presented are preliminary and based on the results of the socio-economic surveys in six CPCs, namely, Algeria, Egypt, Lebanon, Morocco (only for self-consumption), Tunisia and Turkey.

Self-consumption describes the part of the production that is not sold commercially and is, instead, typically distributed amongst the crew members for their own consumption. The share of the landings that are not sold commercially is 7.4 percent for the small-scale vessels group, and varies from 6.5 percent for purse seiners and pelagic trawlers to 2.1 percent for trawlers and beam trawlers (Figure 51). This information suggests that about 37 600 tonnes of fish in total (approximately 5.7 percent of landings) do not therefore make their way into any value chain for this group of CPCs, yet are likely to represent an important component of food security, and in particular to the livelihoods of fishers, in the region.

Of the remaining landings that are sold commercially, the destination at first sale varies depending on the fleet segment group. In general, the main destinations (in terms of value) are fishing port auctions (especially for industrial

FIGURE 51. Percentage of landings not sold commercially (used for self-consumption) by fleet segment group

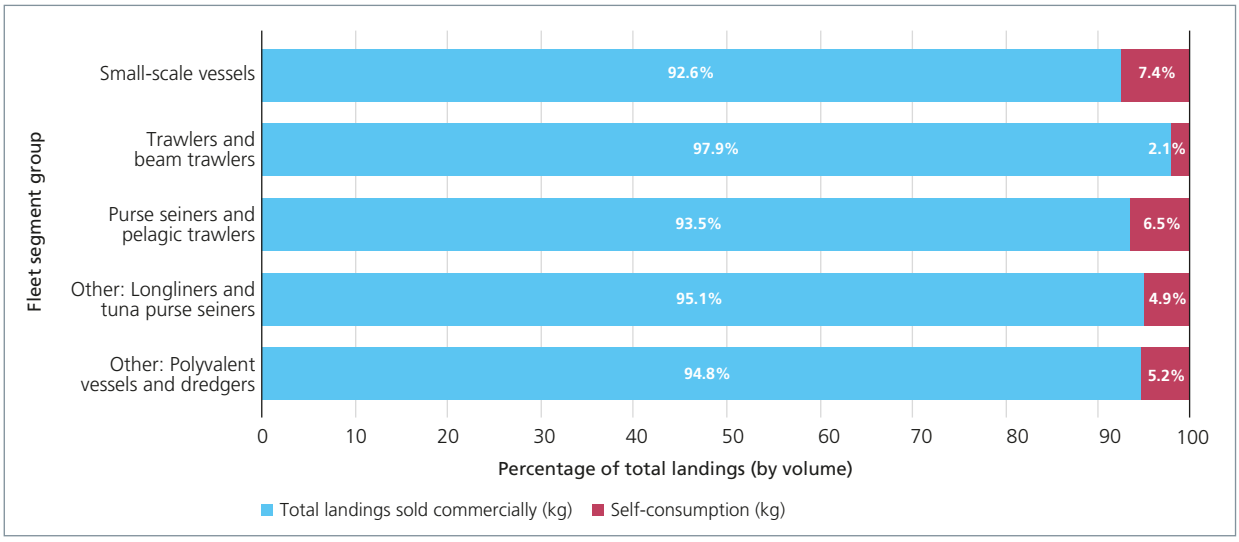
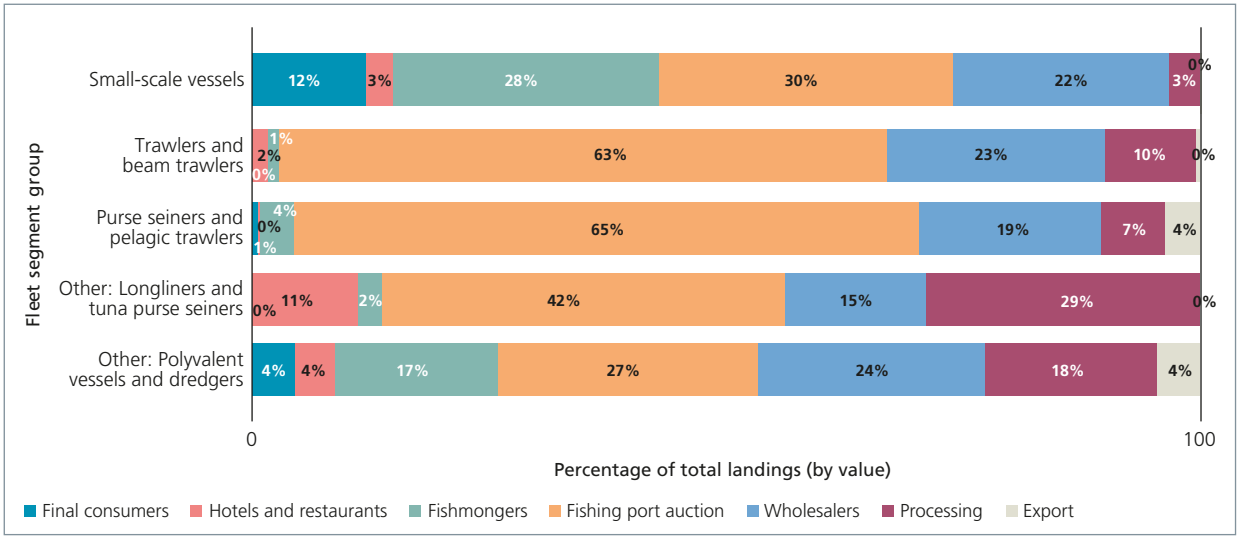


FIGURE 52. Destination of commercially-sold landings by fleet segment group



fisheries, e.g. for purse seiners and pelagic trawlers, auctions account for up to 65 percent) and wholesalers (Figure 52). However, SSF clearly depend on shorter value chains, with direct selling to final consumers, hotels, restaurants and fishmongers representing over 42 percent of sales by value. Quite distinct from other vessel groups, 42 percent of all landings (in terms of value) of longliners and tuna purse seiners are destined to processing.

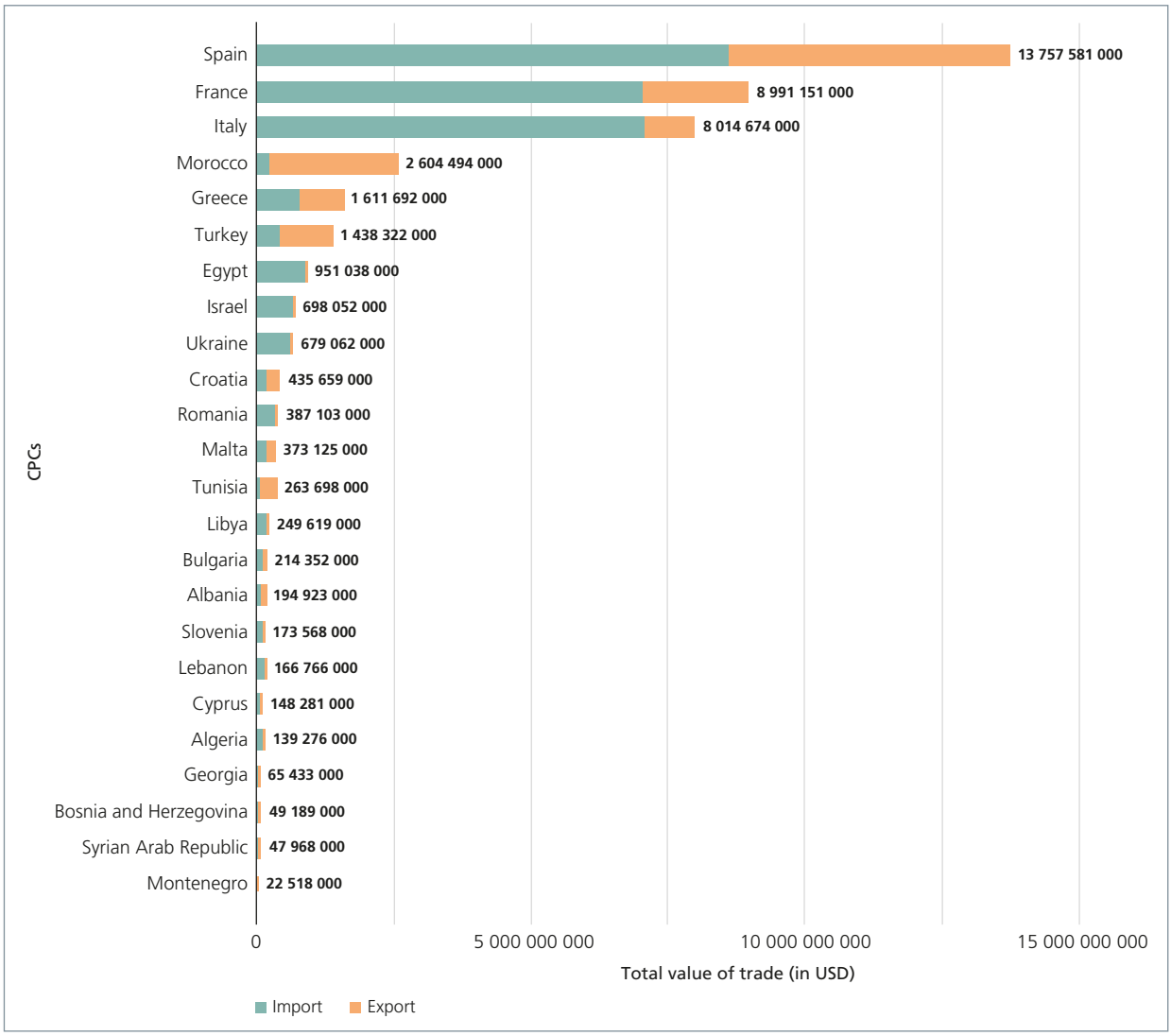
Trade

Fish and fishery products are some of the most highly traded food commodities in the world by value (FAO, 2020c). The Mediterranean and Black Sea region is no exception, with trade of fish products – particularly between European Union and non-European Union CPCs – essential for the profitability of the region's fisheries sector. Indeed, as demonstrated during the height of the COVID-19 pandemic, the closure of borders and restrictions on the import and export of goods had significant impacts on the sector (GFCM, 2020b; see also Box 16).

Furthermore, trade is not just essential for industrial fisheries, but also for SSF, where, despite the predominance of short value chains and more direct sales of products at the regional level (see Figure 52), in certain countries, select high-value SSF target species are destined almost exclusively for foreign markets, in particular European Union markets.

The total value of traded fish products (imports plus exports) in the GFCM area of

FIGURE 53. Total value of traded fish products by GFCM contracting party and cooperating non-contracting party (imports and exports)



application is USD 41.7 billion, over 11 times the revenue at first sale (Figure 53). As trade data are not collected through the GFCM, data are obtained from the FAO Fishery Commodities Global Production and Trade database (reference year 2018) and are aggregated by country. It is important to note that, due to this aggregation by country, included within the total value are aquaculture products, re-exports, as well as capture fisheries products not originating from the GFCM area of application for those countries bordering multiple FAO fishing areas (i.e. Egypt, France, Morocco and Spain).

In addition to the total value of trade, it is also useful to understand the standardized trade balance (STB), which indicates whether a country is a net importer or a net 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; an STB of zero indicates a perfect balance between imports and exports.

In the GFCM area of application, CPCs are generally net importers (Figure 54). In particular,

FIGURE 54. Standardized trade balance by GFCM contracting party and cooperating non-contracting party

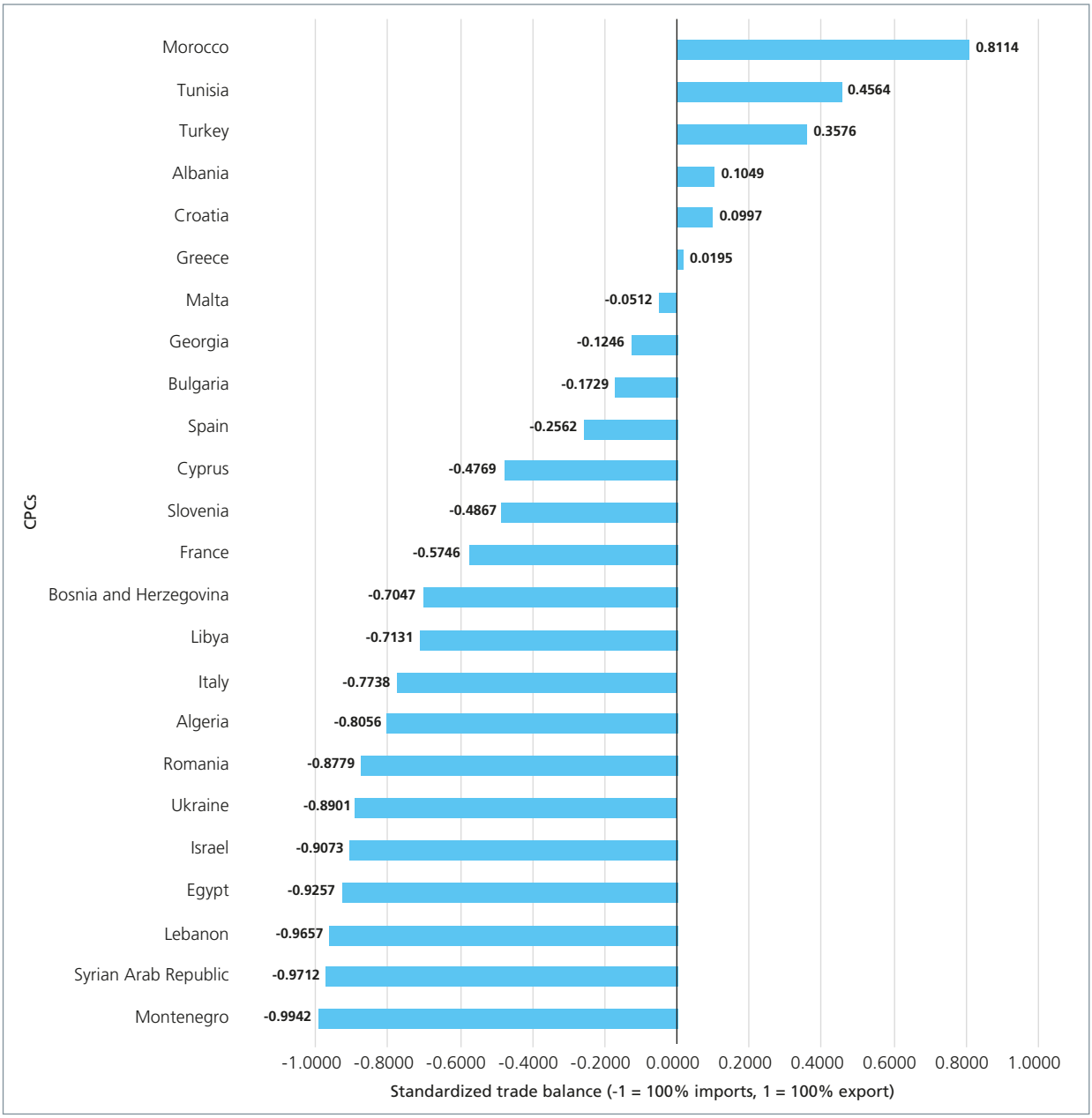


FIGURE 55. Standardized trade balance by GFCM subregion

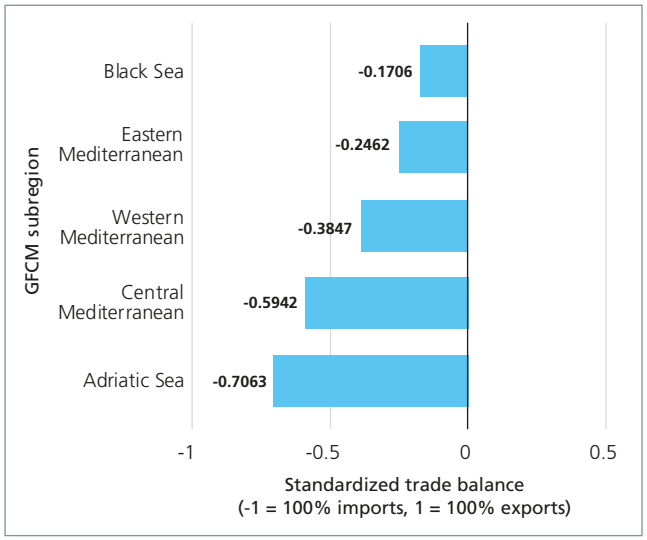
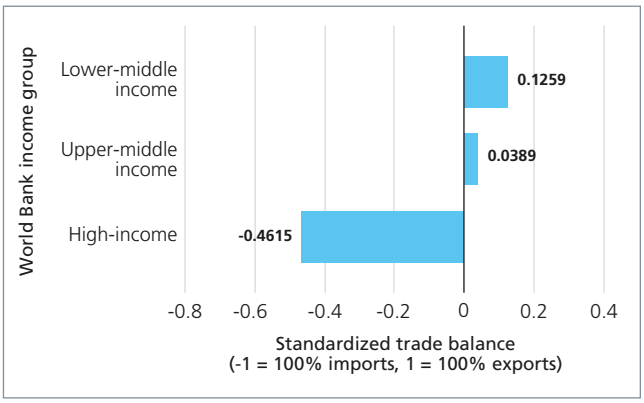


FIGURE 56. Standardized trade balance by income group classification



Montenegro, the Syrian Arab Republic and Lebanon depend almost entirely on imports of fishery products. On the other hand, Morocco – and to a lesser extent also Tunisia and Turkey – has a significant net export ratio. At the subregional level, all GFCM subregions are net importers of fish products (Figure 55), with the Adriatic Sea subregion most highly dependent on imports. However, when analysing trade balances by World Bank income group classification (e.g. lower-middle income economies, upper-middle income economies and high-income economies), a direct correlation emerges between income level and trade balance (Figure 56), with lower-income countries tending to export more and higher-income countries importing more.

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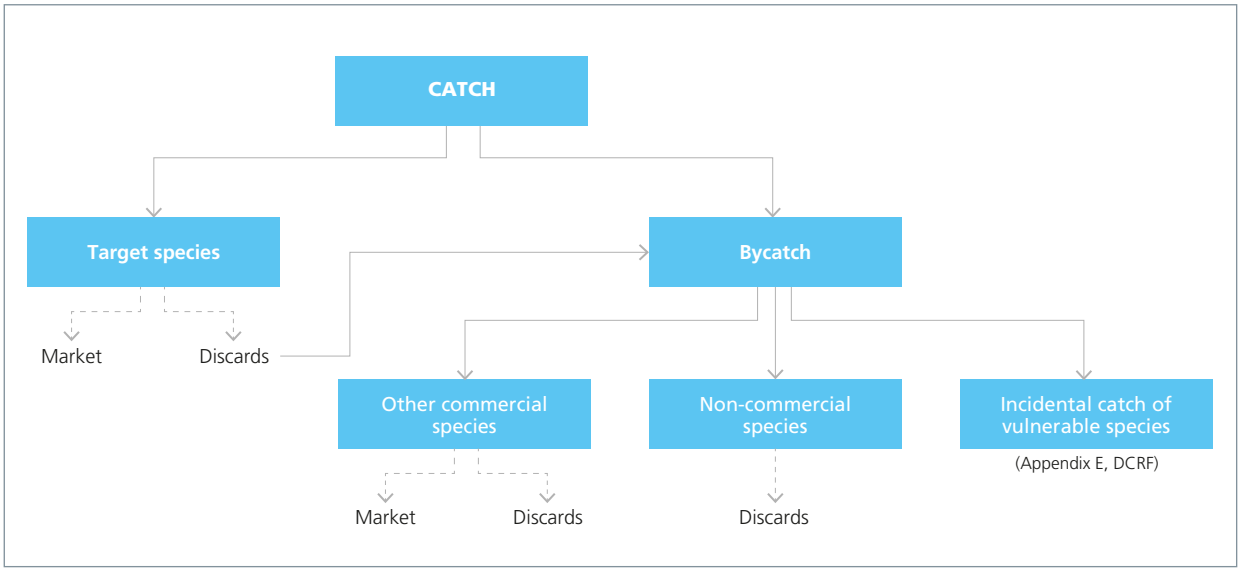
4. Bycatch – discards and incidental catch of vulnerable species

The commonly agreed definition of bycatch, as reported in the GFCM Data Collection Reference Framework (DCRF) (GFCM, 2018a), is "the part of the catch that is unintentionally captured during a fishing operation in addition to target species. It may refer to the catch of other commercial species that are landed, commercial species that cannot be landed (e.g. undersized, damaged individuals), discards of non-commercial species, as well as to incidental catch of endangered, vulnerable or rare species (e.g. sea turtles, seabirds, sharks and marine mammals)" (Figure 57). Defining bycatch is particularly challenging in the Mediterranean and the Black Sea due to the variety of fishing activities and species caught and the dynamic nature of the discarded components (see Chapters 1, 2 and 3). There are therefore historical differences in the definition of bycatch at the country level, various functional interpretations of bycatch, including as catch that a fisher did not intend to catch but could not avoid catching, and different regulatory interpretations of bycatch in fisheries management plans, which may vary from country to country.

Bycatch from fishing activities is a complex concept with significant implications for the sector, including from economic, regulatory and public perception perspectives. With respect to future yields, it affects harvested resources by increasing

FIGURE 57. Diagram of catch composition

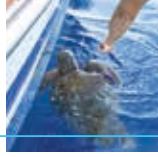


the mortality of juvenile and undersized individuals of target species, removing them before they reach their optimal size, while from a biodiversity conservation perspective, bycatch presents a threat to vulnerable species. Furthermore, bycatch incurs additional costs without increasing revenues and it may hinder profitability, while also creating a negative perception of fishing activities within society. As such, bycatch is usually the object of national and international regulations, including within the context of the GFCM and its management plans (see Chapter 7).

Bycatch of vulnerable species jeopardizes the conservation of a variety of species groups, including marine mammals, seabirds, sea turtles, sharks and rays. Similarly, the bycatch of species such as corals and sponges can also cause damage to protected corals and important fish habitats. Moreover, the bycatch of fish (or cephalopods or crustaceans) can affect biodiversity by impacting top predators, removing individuals of many species or eliminating prey; it can disturb ecosystems by transferring biomass between water layers or increase the risk of overexploitation when the level of incidental capture is not sustainable for a species (Swan and Gréboval, 2005).

Understanding bycatch and adopting effective measures to reduce it therefore represent essential steps towards minimizing the impacts of fisheries on vulnerable species, discards, and more generally on marine ecosystems, as well as towards ensuring a sustainable fishery sector. To address this issue and better understand bycatch, the GFCM is working with fishers, national and international partners, environmental organizations and researchers to develop new tools and approaches for reducing bycatch and to implement management measures.

Since the last issue of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018), the GFCM has launched a number of initiatives to improve knowledge on bycatch by fleet, subregion and species group across the Mediterranean and Black Sea. The most important of these projects include the implementation of discards monitoring programmes in several countries and participation in the MedBycatch project «Understanding Mediterranean multi-taxa bycatch of vulnerable species and testing mitigation – a collaborative approach» (GFCM, 2020g), to monitor and mitigate incidental catch of vulnerable species. The GFCM is also involved in the depredation projects «Towards solutions to interactions between fisheries and cetaceans in Moroccan and Tunisian waters» (GFCM, 2020f) and «Mitigating dolphin depredation in Mediterranean fisheries – Joining efforts for strengthening cetacean conservation and sustainable fisheries», aiming to reduce depredation by dolphins in fishing gear. Additionally, two GFCM resolutions (Resolution GFCM/43/2019/6 on the establishment of a set of measures to protect vulnerable marine ecosystems formed by cnidarian (coral)



communities in the Mediterranean Sea and Resolution GFCM/43/2019/2 on enhancing the conservation of cetaceans in the GFCM area of application), and one recommendation (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), have been adopted (FAO, 2020b).

Despite some delays in the collection and analysis of bycatch data, mostly related to the impacts of the COVID-19 pandemic (Box 16), updated relevant information and analysis referring to the incidental catch of vulnerable species have been prepared for this issue of *The State of the Mediterranean and Black Sea Fisheries*, while updated information on discards is still being analysed. This chapter therefore focuses on providing a new comprehensive analysis of the incidental catch of vulnerable species (see page 66); a summary of actions taken towards preparing an updated analysis of discards is also provided (see next section on discards).

DISCARDS

According to the analysis carried out in *The State of the Mediterranean and Black Sea Fisheries* (FAO, 2018), discards in the Mediterranean are estimated at around 230 000 tonnes per year, corresponding to approximately 18 percent of the catch. In the Black Sea, discards are estimated at around 45 000 tonnes (between 10 and 15 percent of the total catch). In both cases, the trawl fishery is generally responsible for the bulk of discards in all the Mediterranean and Black Sea geographical subareas, while available information for small-scale fisheries suggests that the discard rate is generally lower than 10 percent (FAO, 2018).

As previously reported, these estimates "are far from being complete, and suffer from low precision. Information was lacking for many types of fishing gear, countries and GFCM subregions, and most available studies only cover relatively short periods and small areas." These knowledge gaps underlined the need to expand discard monitoring programmes and to standardize practices, so as to assess discards appropriately and address their important impacts (e.g. discards continue to represent a major source of uncertainty about the actual fishing mortality rates of several commercial stocks).

To address this issue, and also as a response to the priorities identified by Mediterranean and Black Sea countries in the context of international commitments and regional strategies (i.e. the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries), the first regional protocol on *Monitoring discards in Mediterranean and Black Sea fisheries: Methodology for data collection* was published in 2019 (FAO, 2019a). This publication and the methodology discussed therein aim to provide a framework for the development and implementation of an efficient, standardized data collection and monitoring system for discards in all Mediterranean and Black Sea countries, involving onboard observations, questionnaires at landing sites and self-sampling (by fishers). It establishes minimum common standards for the collection of discard data, allowing for repeatability and comparisons among fisheries across the region and offering a harmonized basis of knowledge, information and evidence for decision-making by:

- providing a minimum set of standards for the collection of discards data, consistent with GFCM requirements;
- standardizing the data to be collected, including the forms to be used; and
- specifying minimum standards for the development of a data collection programme in countries without a discard monitoring programme.

The publication was produced ahead of the implementation of a GFCM discards monitoring programme in Albania, Algeria, Egypt, Lebanon, Montenegro, Morocco, Tunisia, Turkey and Ukraine, between 2019 and 2020, whose results will provide, in the near future, a clear overview of this phenomenon in these areas and support the identification of appropriate management measures both at the subregional and regional levels.

Box 12 provides, in the form of a SWOT (strengths, weaknesses, opportunities and threats) analysis, a preliminary reflection on the activities carried out during the GFCM discards monitoring programme in those countries. Working from the pros and cons of the methodology used and analysing how the monitoring activities were conducted could help improve and/or capitalize on the different aspects of the programme (e.g. advantages

and disadvantages, future developments, how to progress, etc.) with a view to wider implementation across the whole region. A complete reanalysis of discard rates based on the new data and information collected through these programmes is expected to be carried out for the next issue of *The State of Mediterranean and Black Sea Fisheries* in 2022.

INCIDENTAL CATCH OF VULNERABLE SPECIES

This section presents a compilation and a review of available information on the incidental catch of vulnerable species in different fisheries within the GFCM area of application. The information used to produce this overview has been collected from 2000 through the present from the following sources: i) data from the forthcoming GFCM publication *Regional review of incidental catch of vulnerable species in Mediterranean and Black Sea fisheries* (Carpentieri *et al.*, forthcoming); ii) FAO reports and technical papers; and iii) the DCRF (GFCM, 2018a). After analysing all the information collected, a quantitative and qualitative evaluation by major vessel group[9] (as identified in Appendix B of the DCRF) and by GFCM subregion is presented.

For the purposes of this document, attention was focused on the conservation-priority species listed in the DCRF (GFCM, 2018a; see Table 3), which include both those included in Annex II (endangered or threatened species) and those in Annex III (species whose exploitation is regulated) of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, as well as those on the Red List of Threatened Species of the International Union for Conservation of Nature (IUCN) (IUCN, 2020). Several of those vulnerable species are already included in different GFCM recommendations

[9] Fishing vessels, regardless their size, using the same gear for more than 50 percent of the time at sea during a year.

Box 12. Analysis of strengths, weaknesses, opportunities and threats for activities carried out within the framework of the GFCM discards monitoring programme

Discards monitoring programme: SWOT analysis

Strengths	Weaknesses
• Cooperative approach. • Use of a common and standard protocol. • Enhances the bond between researchers, governments and fishers. • Increases awareness among fishers regarding discards. • Introduces the discard concept as a parameter for studying interactions between fish stocks and fishing activity. • Increases experience in scientific teams engaged in the examination of collected biological samples and in processing and analysing the data. • Increases knowledge of the qualitative and quantitative impacts of discards. • Increases knowledge of the spatio-temporal distribution of discards.	• Initial difficulties in cooperation with fishers. • Lack of cooperation from fishers, especially with respect to some methodologies concerning self-sampling operations and questionnaires. • Lack of funds to guarantee good coverage of fishing activities. • Lack of experience of some observers. • Lack of expertise in identifying all the species in the catch composition (e.g. macrobenthos, sharks and rays, non-target species). • Difficulties in processing biological samples. • Lack of staff and difficulties in recruiting onboard observers.
Opportunities	**Threats**
• Improving communications between managers, fishers and researchers. • Raising awareness of fishers to the importance of this programme for decision-making and the measures necessary to mitigate discards. • Potential to increase the participation of fishers in decisions. • Potential to train fishers and data collectors in species identification and in data collection in general. • Increasing awareness of a better utilization of marine resources. • Improving the knowledge of fishers in sustainable fishing practices. • Acquisition of data on discarded species as well as on vulnerable species and ecosystems in general. • Improving the knowledge of biodiversity and of the spatial distribution of resources in newly exploited areas. • Providing a chance to reflect on and/or note marine litter. • Improving data variety and data quality available for fisheries managers.	• Increasing costs of the monitoring programme. • Reluctance of some fishers to accept the concept of discards. • Reluctance of some fishers to host onboard observers. • Difficulties for researchers going onboard small-scale fishing vessels. • Political instability of some areas. • Unsustainability of certain fishing activities.

(Recommendation GFCM/42/2018/2; Recommendation GFCM/35/2011/3 on reducing incidental bycatch of seabirds in fisheries in the GFCM area of application; Recommendation GFCM/35/2011/4 on the incidental bycatch of sea turtles in fisheries in the GFCM area of application; Recommendation GFCM/35/2011/5 on fisheries measures for the conservation of the Mediterranean monk seal in the GFCM area of application; Recommendation GFCM/36/2012/2 on mitigation of incidental catches of cetaceans in the GFCM area of application; Recommendation GFCM/36/2012/3 on fisheries management measures for conservation of sharks and rays in the GFCM area of application and Recommendation GFCM/41/2017/6 on the submission of data on fishing activities in the GFCM area of application).

Overview

It is worth noting that the geographical and historical coverage of the data analysed varies greatly, and that only studies reporting individual values of vulnerable species were considered. Therefore, the data presented in this chapter should be considered as a likely underestimate of the frequency and volume of the incidental catch of vulnerable species in the GFCM area of application. Nevertheless, this analysis is more comprehensive than those of previous issues of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2016, 2018). It provides useful insights on the relative impacts of different fishing activities on the different groups of vulnerable species, as well as a comparative subregional perspective, including information on the relative volume and frequency of the incidental catch by species groups.

Overall, from a strictly numerical point of view, sea turtles (around 89 percent) and elasmobranchs (around 8 percent) continue to represent the highest share of reported incidental catch of vulnerable species. Seabirds and marine mammals (together, around 4 percent of the total) are the two groups of bycatch with the lowest numbers of reported specimens. This dynamic is clearly reflected also in the number of specimens comprising bycatch by vessel group (Figure 58); longliners and bottom trawlers are the most relevant vessel groups affecting conservation-priority species in the whole region.

Concerning the spatial distribution of recorded bycatch, the bulk of reported information (i.e. the number of specimens comprising bycatch) is equally distributed between the western and central Mediterranean (around 31 percent in both subregions). In the Adriatic Sea (around 19 percent) and the eastern Mediterranean (around 15 percent), the information is more scattered. The information reported for the Black Sea is very limited (around 2 percent) and refers only to a few groups of vulnerable species (i.e. marine mammals and elasmobranchs) (Figure 59).

FIGURE 58. Reported incidental catch by species group and vessel group (in relative terms) in the GFCM area of application, 2000–2020

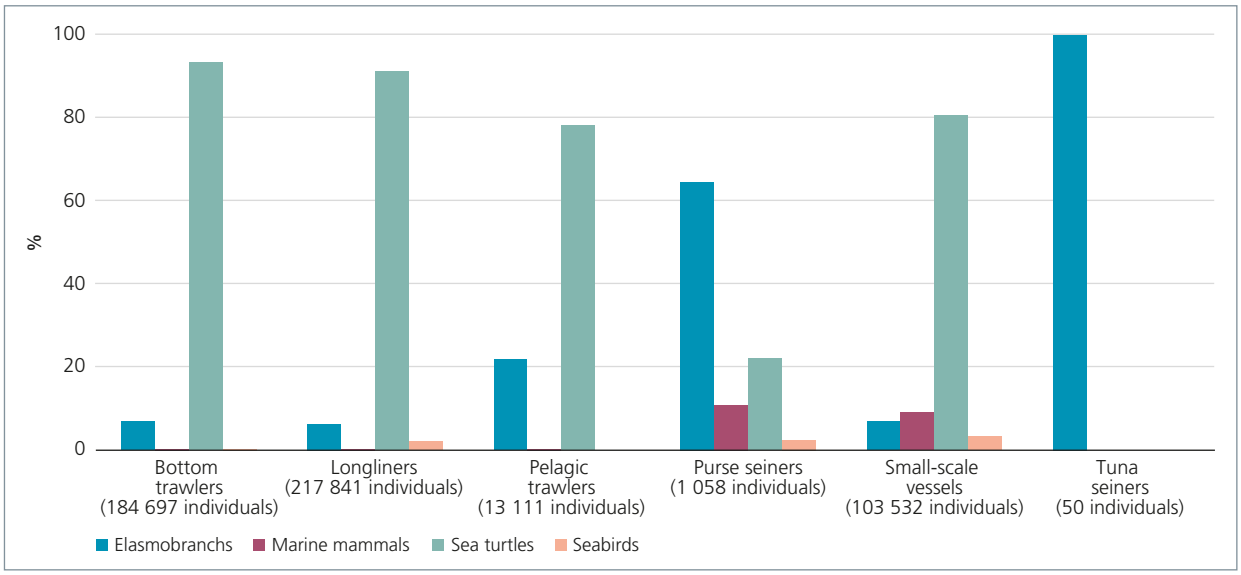
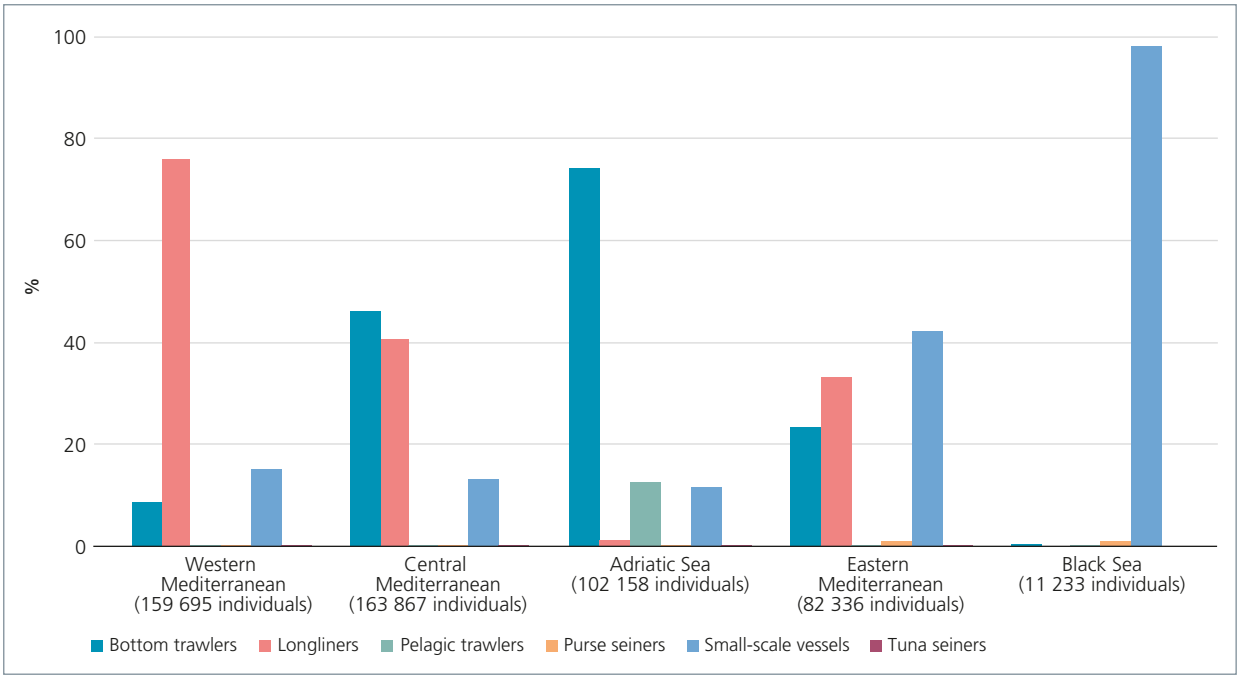


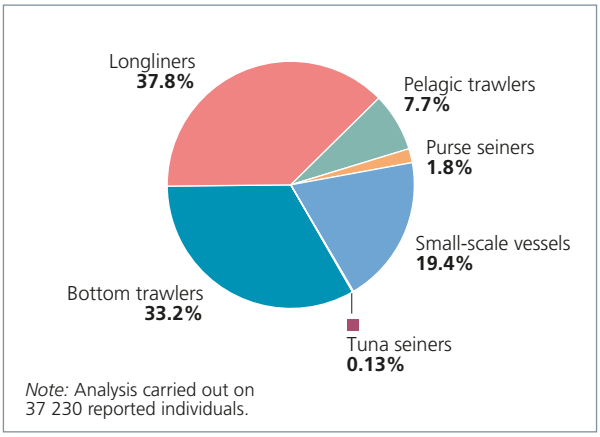
FIGURE 59. Reported incidental catch by vessel group and GFCM subregion (in relative terms), 2000–2020



Elasmobranchs

Longliners (with 14 064 individuals reported) – set and drifting grouped together – and bottom trawlers (12 351 individuals) are by far the vessel groups with the greatest impact on conservation-priority elasmobranch species in the whole region. According to the collected data, small-scale vessels (7 231 individuals) and pelagic trawlers (2 851 individuals) represent vessel groups with minor impact on this group of vulnerable species. Purse (683 individuals) and tuna seiners (50 individuals) seem to have the lowest impact (Figure 60).

FIGURE 60. Reported incidental catch of elasmobranchs by vessel group in the GFCM area of application, 2000–2020



Note: Analysis carried out on 37 230 reported individuals.

A more variegated picture emerges when considering the impact by vessel group in each of the GFCM subregions (Figure 61). In the Adriatic Sea, the bulk of the records comes from pelagic trawlers (around 81 percent). In the western Mediterranean, almost all the elasmobranch bycatch is attributed to bottom trawlers (92 percent). In the central Mediterranean, longliners (77 percent) represent the vessel group with the absolute highest number of available records (around 12 910 individuals reported in the area). Those numbers demonstrate that, in the central Mediterranean, the biomass and the relative abundance of conservation-priority elasmobranch species is still high when compared to other areas. In the eastern Mediterranean, trawlers (44 percent) still represent the vessel group with the highest incidental catch, with traditional coastal purse seiners (about 10 percent) also responsible for a considerable portion of the elasmobranch bycatch in the area.

A certain level of elasmobranch bycatch by small-scale vessels is reported in all the GFCM subregions, with the bulk of the catch reported from the Black Sea, where around 97 percent of the bycatch is attributed to passive gear (i.e. trammel nets and gillnets). Few records of elasmobranch bycatch in tuna seiners (including tuna traps) are reported from the western

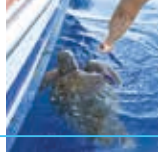
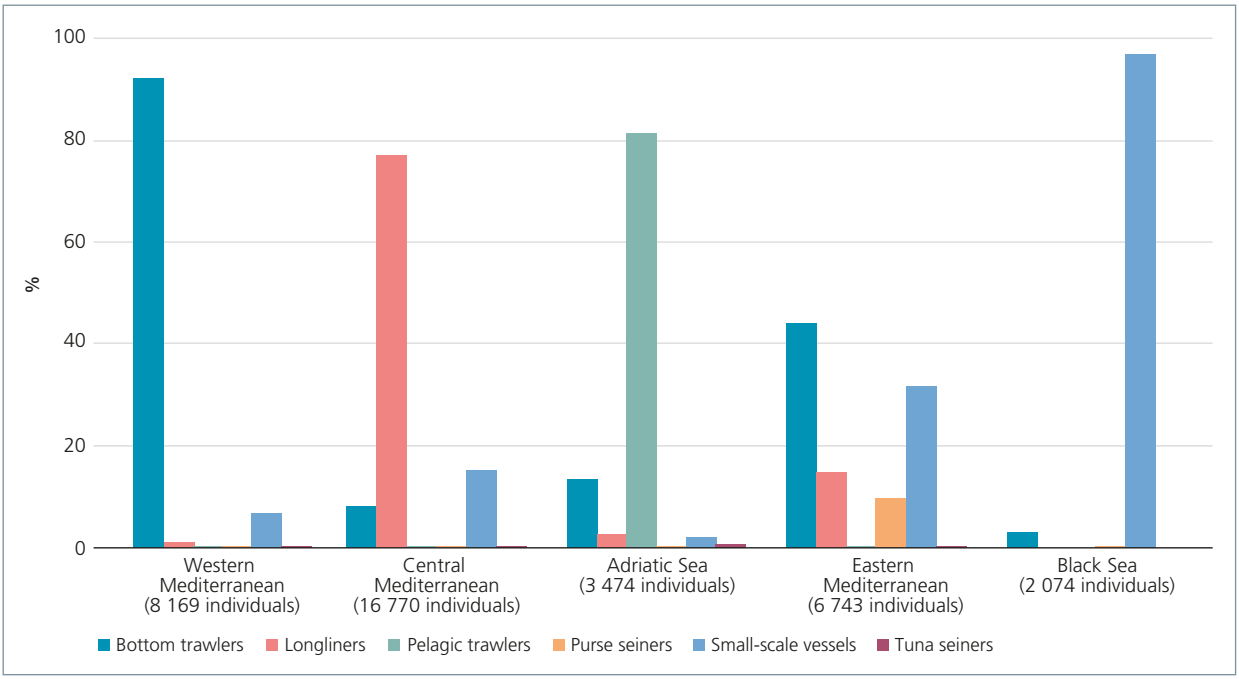


FIGURE 61. Reported incidental catch of elasmobranchs by vessel group and GFCM subregion, 2000–2020

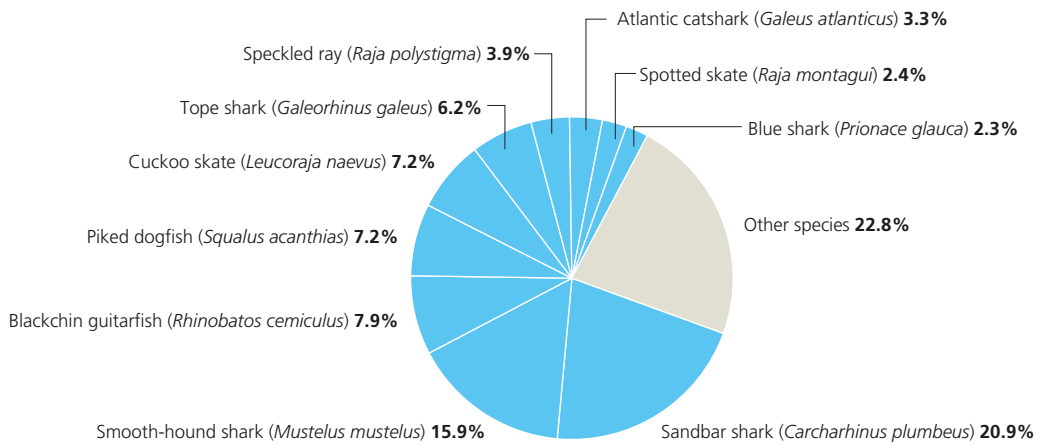


Mediterranean (23 individuals) and the Adriatic Sea (17 individuals).

Figure 62 shows the incidental catch of select elasmobranch species in the Mediterranean. Forty-nine species were identified, with the sandbar shark (*Carcharhinus plumbeus*), accounting for 7 884 individuals, and the smooth-hound shark (*Mustelus mustelus*), at 5 985 individuals – both species present in Annex III of the Barcelona Convention – being the most frequently captured (representing 21 percent and 16 percent of the total elasmobranch bycatch, respectively).

In the Black Sea, about 99 percent of the reported elasmobranch bycatch is represented by the common stingray (*Dasyatis pastinaca*), comprising 2 051 individuals, a species considered "vulnerable" and described as showing a decreasing trend in abundance by the IUCN Red List. The low presence of the piked

FIGURE 62. Reported incidental catch of the main elasmobranch species in the Mediterranean Sea, 2000–2020



Note: Analysis carried out on 37 729 individuals.

dogfish (*Squalus acanthias*) (Annex III of the Barcelona Convention) in the subregion's bycatch composition could confirm the recorded decrease in biomass of this species (GFCM, 2018d).

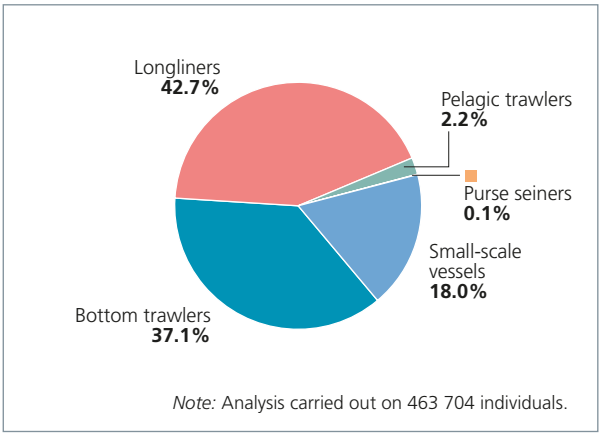
Sea turtles

Sea turtles are incidentally caught by various types of gear (Figure 63). The highest rates of capture of these animals are attributed to fisheries operating in coastal waters or near-shore zones (potential feeding areas for sea turtles). From the analysed data, longliners (197 866 individuals) and bottom trawlers (172 089 individuals) are the vessel groups with the highest incidental catch of sea turtles. Small-scale vessels (using different types of passive gear) and pelagic trawlers are responsible for about 83 285 and 10 229 capture events, respectively. Other vessel groups seem to have a negligible impact on sea turtles. Sea turtles are so rare in the Black Sea that it was not possible to assess the impact of fishing activities there.

The analysis per GFCM subregion shows divergent impacts depending on the vessel group (Figure 64). Based on the available data, longliners (82 percent) represent the major vessel group interacting with sea turtles in the western Mediterranean and, to a lesser extent, in the central Mediterranean (around 36 percent). The current data suggest a greater importance of bottom trawlers responsible for sea turtle bycatch across all GFCM subregions, with the highest interaction rates recorded in the Adriatic (76 percent), central Mediterranean (50 percent) and eastern Mediterranean (22 percent). The bycatch from small-scale vessels is around 12 percent in all the subregions, with the exception of the eastern Mediterranean, where this fishing activity has showed the highest impact on sea turtles (44 percent).

Concerning species composition, bycatch data indicated the loggerhead turtle (*Caretta caretta*) as the main species (around 99 percent, i.e. 458 084 individuals), interacting with all the different fishing activities (Figure 65). Referring

FIGURE 63. Reported incidental catch of sea turtles by vessel group in the GFCM area of application, 2000–2020



Note: Analysis carried out on 463 704 individuals.

FIGURE 64. Reported incidental catch of sea turtles by vessel group and GFCM subregion, 2000–2020

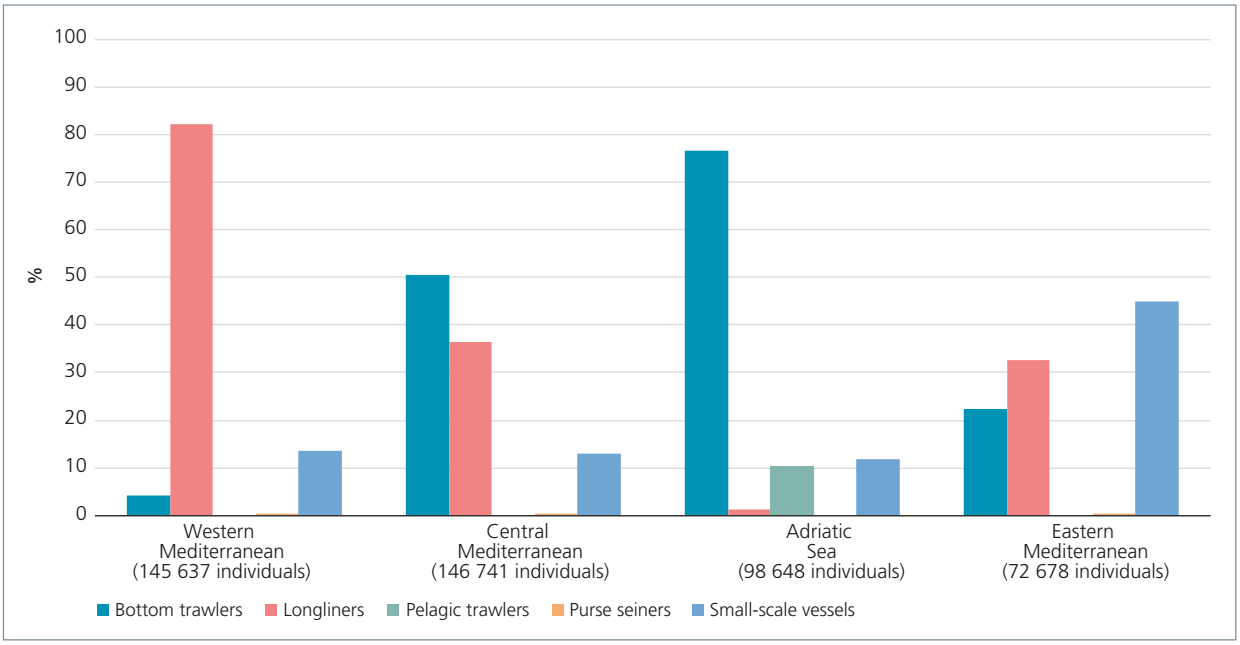
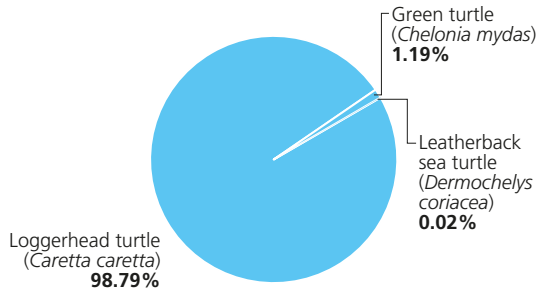
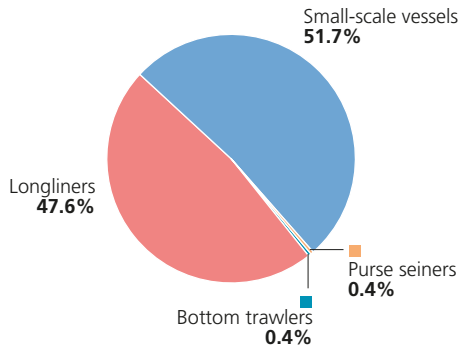


FIGURE 65. Reported incidental catch of the main sea turtle species in the Mediterranean Sea, 2000–2020



Note: Analysis carried out on 463 687 individuals.

FIGURE 66. Reported incidental catch of seabirds by vessel group in the GFCM area of application, 2000–2020



Note: Analysis carried out on 6 751 individuals.

to recorded data, the green turtle (*Chelonia mydas*), comprising 5 498 individuals, and the leatherback sea turtle (*Dermochelys coriacea*), at 105 individuals, represent the other impacted species.

Seabirds

Overall, the available data on seabird bycatch across the GFCM area of application are scarce and unequally distributed, with data mainly gathered in the western Mediterranean. No records could be found for the Black Sea or from North African Mediterranean countries. About 99 percent of the available records in the Mediterranean on seabird bycatch refer to longliners (3 212 individuals reported) and small-scale vessels (3 487 individuals). The incidental catch from purse seiners (25 individuals) and bottom trawlers (27 individuals) seems lower (Figure 66). This dynamic is consistent with the data available from other regions of the world, indicating that research effort is focused primarily on the impacts of longlines and set nets. No records of seabird bycatch were found for pelagic trawlers (using midwater pair trawls) or tuna seiners.

The data by GFCM subregion confirm that longliners and small-scale vessels are the vessel groups with the highest incidental catch in all the areas (Figure 67).

The higher incidental catch from longliners and small-scale vessels (using set longlines) could be linked to the importance of these fishing activities across the whole Mediterranean Sea and to the presence of some endemic and threatened (according to the IUCN Red List) seabird species (Figure 68), for which the western Mediterranean,

FIGURE 67. Reported incidental catch of seabirds by vessel group and GFCM subregion, 2000–2020

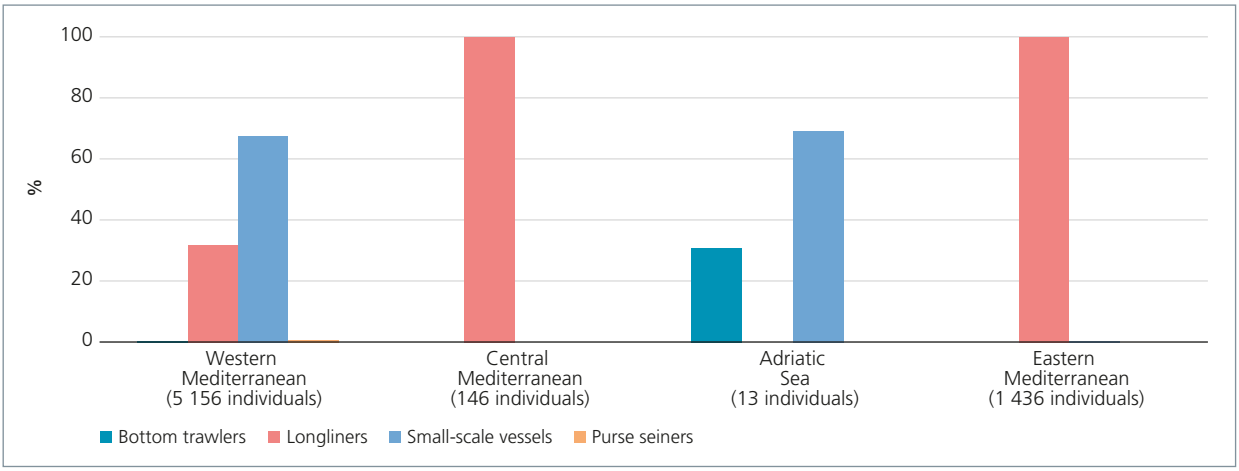
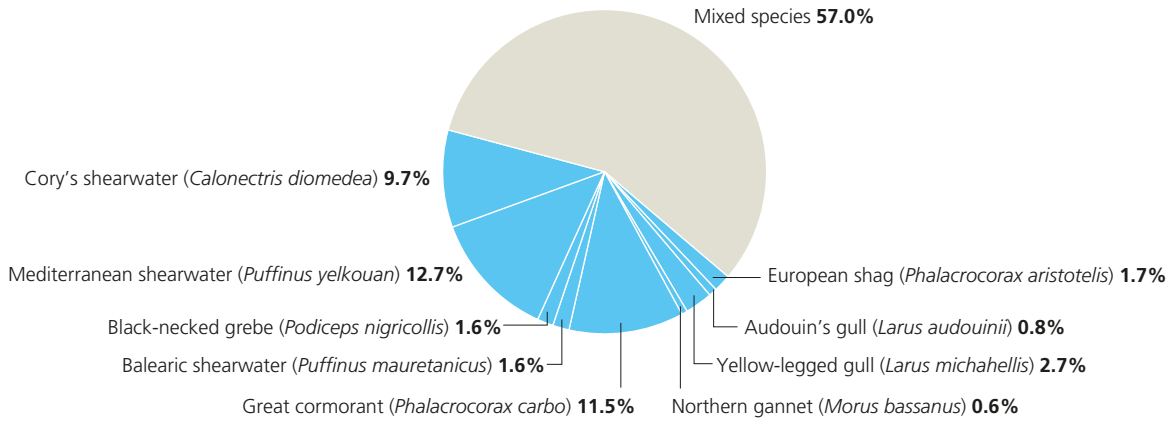


FIGURE 68. Reported incidental catch of the main seabird species in the Mediterranean Sea, 2000–2020

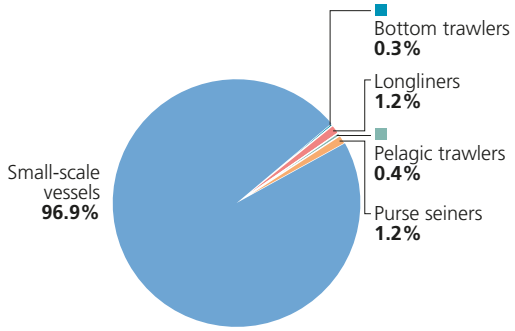


Note: Analysis carried out on 6 767 individuals.

in particular, represents an important breeding area, as well as a major feeding ground. This analysis seems to be confirmed by the fact that in the Mediterranean, the interaction rates between seabirds and fishing activities seem low when compared to other areas of the world, even though the available data include two of the most threatened seabirds in Europe, the Yelkouan shearwater (*Puffinus yelkouan*) and the Balearic shearwater (*P. mauretanicus*).

In Figure 68, many individuals have been aggregated as "mixed species" and reported collectively due to difficulties in species identification (levels of taxonomic expertise vary among GFCM subregions). More data and analysis are therefore needed to properly assess the degrees of impact at the species level and in the different areas.

FIGURE 69. Reported incidental catch of marine mammals by vessel group in the GFCM area of application, 2000–2020



Note: Analysis carried out on 9 836 individuals (676 in the Mediterranean and 9 160 in the Black Sea).

Marine mammals

The relationship between monk seals, cetaceans and fishing activities/fishers has been conflictual over time, more or less so depending on the historical period, type of fishing gear, species involved and socio-economic issues. Nonetheless, from a strictly numerical point of view, the datasets analysed indicate that in recent years, the incidental catch of cetaceans in Mediterranean fisheries has decreased with respect to earlier periods, when marine mammal bycatch, caused mainly by pelagic driftnets, was relevant (also for other groups of large marine vertebrate species). The use of these nets was banned in 2005, and since then, only a few studies have reported on the bycatch of marine mammals from other fisheries in the Mediterranean Sea. Over the last decade, studies conducted on incidental catch have declined considerably, while research on direct interactions (i.e. depredation) between marine mammals and fishing gear continues to increase, often with the aim of quantifying its importance and, if possible, also assessing the damage inflicted on fishers from an economic point of view.

Currently, the types of vessel groups with the greatest rates of interactions with marine mammals seem to be those using set gillnets and trammel nets in coastal areas (Figure 69).

This result is confirmed by the subregional analysis (Figure 70) as well, which clearly shows

FIGURE 70. Reported incidental catch of marine mammals by vessel group and GFCM subregion, 2000–2020

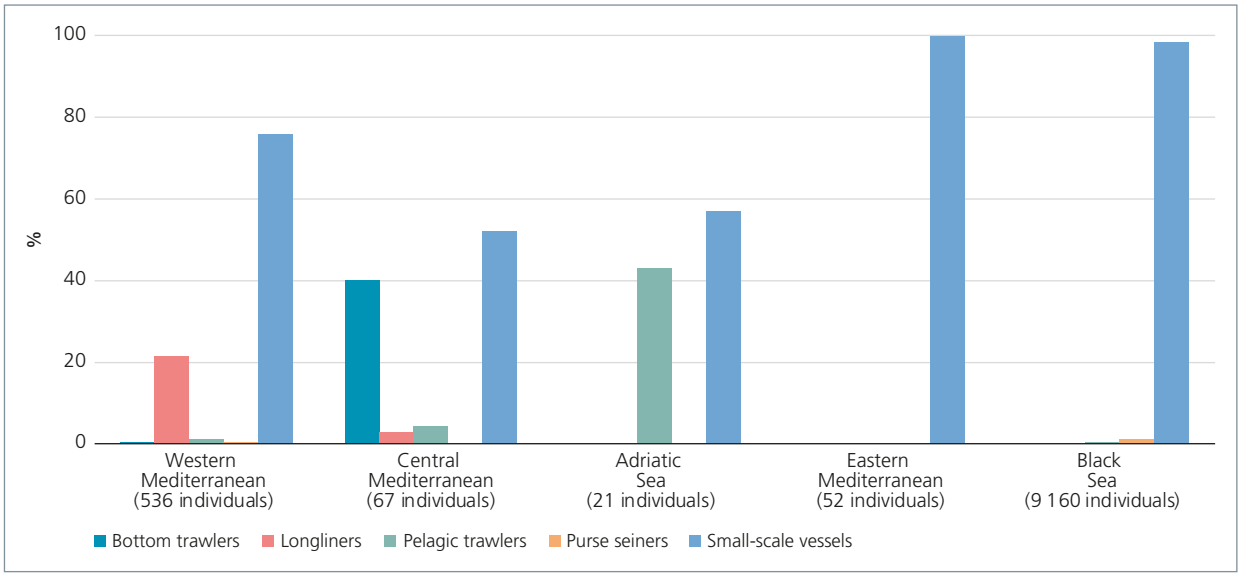
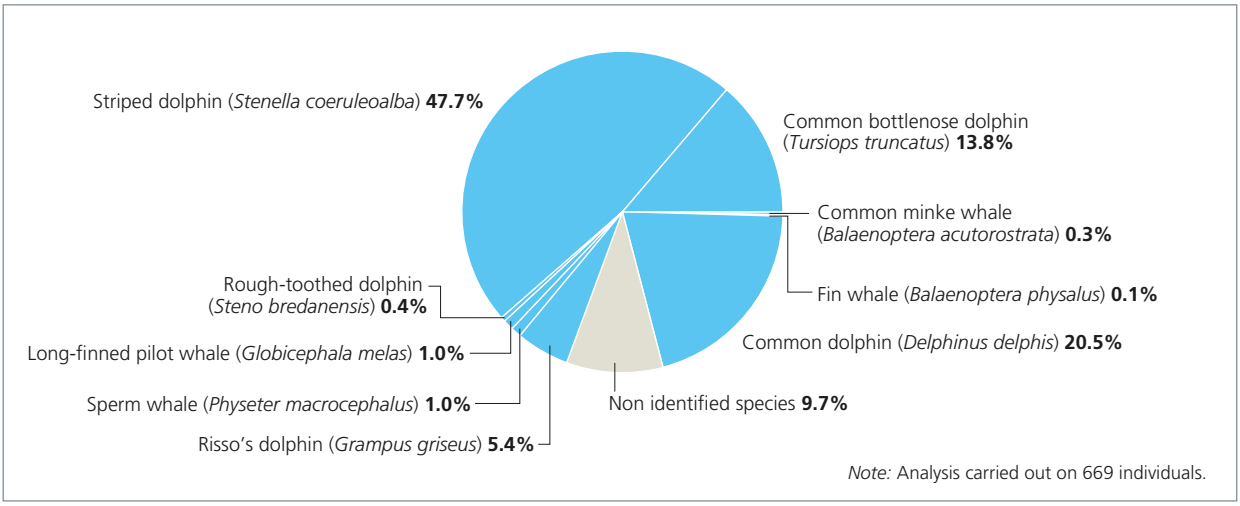


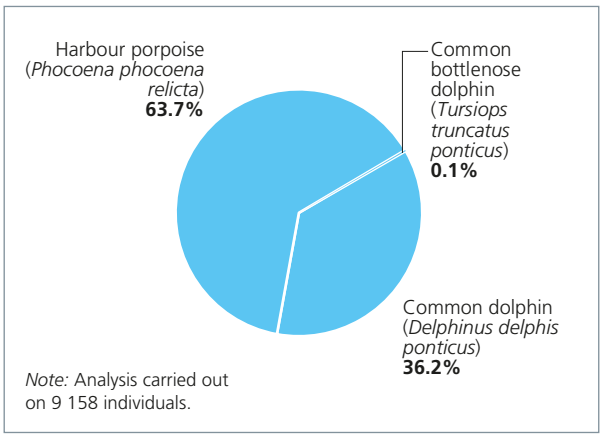
FIGURE 71. Reported incidental catch of the main cetacean species in the Mediterranean Sea, 2000–2020



the degree of interactions between marine mammals and coastal small-scale vessels. Few data are reported from the western Mediterranean for longliners (116 individuals) and from the central Mediterranean for bottom trawlers (27 individuals).

In terms of species bycatch composition, the recorded species of cetaceans decreased considerably once large driftnets were banned and subsequently dismissed. Currently, medium-small cetacean species, such as the striped dolphin (*Stenella coeruleoalba*), the bottlenose dolphin (*Tursiops truncatus*) and the common dolphin (*Delphinus delphis*) are sporadically found in bycatch reports (Figure 71).

FIGURE 72. Reported incidental catch of the main cetacean species in the Black Sea, 2000–2020



Box 13. Key accomplishments of the project on "Understanding Mediterranean multi-taxa bycatch of vulnerable species and testing mitigation – a collaborative approach"

The joint project "Understanding Mediterranean multi-taxa bycatch of vulnerable species and testing mitigation – a collaborative approach" is a partnership, funded by the MAVA Foundation, between the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS), the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO), the Specially Protected Areas Regional Activity Centre (SPA/RAC) of the United Nations Environment Programme/Mediterranean Action Plan (UNEP /MAP), the International Union for Conservation of Nature (IUCN) Centre for Mediterranean Cooperation, BirdLife Europe and Central Asia and the Mediterranean Association to Save the Sea Turtles (MEDASSET).

With a view to promoting synergies and sharing resources and expertise, the project aims to support Mediterranean countries, specifically Morocco, Tunisia and Turkey, in implementing standardized data collection on the bycatch of vulnerable species (during a first phase) and to identify and test measures (during a second phase) for reducing the impact of fisheries on these marine key species across the Mediterranean. Before the start of this project, information and data on the incidental catch of vulnerable species in the target countries (and beyond) was scarce and patchy. The first phase of implementation has provided insights on the occurrence of bycatch in the aforementioned countries, on the identification of the species/taxa most affected, on areas and seasons showing the highest bycatch, on the gear/vessel groups causing the most impact, etc. During the second period of the project implementation (2021–2022), the monitoring activities will continue, extending coverage to other gear/vessel groups, and the trials of mitigation measures will focus on those species/taxa that emerged as most impacted, as determined by both observation programmes and the forthcoming GFCM publication *Regional review of incidental catch of vulnerable species in Mediterranean and Black Sea fisheries* (Carpentieri *et al.*, eds, forthcoming).

Deliverables of the first phase, such as the first standardized methodology for the collection of data on the bycatch of vulnerable species, the identification guide of vulnerable species incidentally caught in fisheries, the regional bycatch review and the multi-taxa database, represent important resources to inform future work on bycatch across the region and to ensure that data, collected in harmonized ways, will be comparable.

Lessons learnt during the first year of implementation and their relevance for future work

- It has been challenging to establish multi-taxa and multi-gear observation programmes. The project has established strong cooperation between project partners and national governments, including through the national focal points. This process has led to the development of trust and to an increasing acknowledgement of the issue of bycatch of vulnerable species as well as increased willingness to engage and take action to address it.
- The support and buy-in of national governments, also facilitated by the national focal points, have been essential for the achievements realized to date.
- Stakeholders in the target countries, including national authorities and fishers, have an increased awareness of bycatch and its impacts, and are therefore increasingly willing to collaborate and support measures to address this issue.
- Building strong and trusting relationships with fishers is vital for the success of projects addressing bycatch.
- Without legislation requiring vessels to accept onboard observers, projects addressing bycatch must rely on the willingness of fishers to collaborate on data collection and the testing of mitigation measures, and there remains the risk that only a part of the vessels operating in a country are reached.
- Communication materials and project activities have helped to raise awareness of the issue of bycatch among the public and decision-makers both at the regional and country levels.
- The project has contributed positive momentum to the issue of bycatch at the regional and subregional levels and can continue taking advantage of this momentum in the second phase.
- Only selected vessel groups were covered during the first year of observation programmes, so the results need to be interpreted carefully. Some other vessel groups could represent a high risk for bycatch of certain taxa but still need to be covered by a monitoring programme to determine if this is the case.

The situation is quite different in the Black Sea, where the coastal fisheries targeting Black Sea turbot continue to have an impact on the cetacean population – which is composed of three endemic species – particularly on the Black Sea harbour porpoise (*Phocoena phocoena relicta*). The incidental catch mainly affects the Black Sea harbour porpoise, as it generally lives in coastal habitats and thus experiences an impact much greater than the other two endemic cetacean species, the Black Sea common dolphin (*Delphinus delphis ponticus)* and the Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*) (Figure 72).

Final remarks

In general, it has always been difficult to make reliable estimates of the incidental catch of vulnerable species in each area and by vessel group/gear type. One of the main obstacles involves the different methods used by researchers in different countries, which are not standardized and make it extremely difficult to compare the results obtained. In fact, most of the available data on the bycatch of vulnerable species are derived from opportunistic and irregular surveys. Some of the variability between GFCM subregions and/or vessel group types may also be due to a number of shortcomings in the quality of data (lack of onboard observer programmes, species identification issues, inadequate spatial and temporal coverage, etc.), which increases uncertainty. Currently, only a few national programmes are active and major knowledge gaps persist in most of the GFCM subregions (Box 13). Improving data collection within a standardized framework therefore remains an urgent priority (FAO, 2019b). Indeed, monitoring programmes on the incidental catch of vulnerable species are essential and represent a fundamental step towards developing and implementing appropriate conservation and management measures for the protection of vulnerable species with resident populations in the Mediterranean and the Black Sea and the concomitant sustainability of the fisheries sector.

5. Status of fishery resources

Data used for the assessment of fishery resources are collected through stock assessment forms (SAFs), which also contain information on biological reference points and the outcomes of assessments (e.g. estimates of fishing mortality, exploitation rates, spawning stock biomass and recruitment); detailed explanations on reference points are provided in Caddy and Mahon (1995). Although assessments have been presented to the Scientific Advisory Committee on Fisheries (SAC) since its establishment in 1997, SAFs were only digitalized in 2007; they are currently stored in a database incorporating 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 and includes 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) for each year up to 2018. Several changes have taken place since the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018). Notably, qualitative assessments providing precautionary advice were included in a number of analyses (e.g. the number of stocks assessed), resulting in a thorough revision of the SAF database and prompting an overall evaluation of qualitative assessments, whose quality was deemed much higher

in recent years than in the past. In light of this development, and with the aim of working from a dataset of comparable quality, the general time series used was shortened and now starts in 2008 instead of 2006. Assessments considered preliminary by the Working Groups on Stock Assessment and not yet resulting in advice are not used in this analysis. Owing to the arrangement of the GFCM calendar, until 2018, all advice on the status of fishery resources within the GFCM was provided based on two-year-old data (Box 14). Since 2018, a system of benchmarking assessments (Box 14) has been adopted by the GFCM that has resulted in some advice being based on one-year-old data.

This chapter provides an overall analysis of the status of resources, carried out in relation to approved reference points. These are mainly linked to indicators of fishing mortality – with the reference point being the fishing mortality that produces maximum sustainable yield (MSY), i.e. F_{MSY} or proxies for F_{MSY} – since few stocks have agreed biomass reference points (limit or precautionary 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 stocks for which indicators (fishing mortality and/or stock biomass) are inside or outside the limits established by relevant reference points. The indicators of current fishing mortality used herein are: i) terminal fishing mortality (i.e. the fishing mortality estimated in the last year of the time series used for an assessment) for small pelagic stocks and demersal stocks assessed with forward assessment methods (e.g. statistical catch-at-age methods (SCAA)); and ii) the average fishing mortality of the last three years for demersal stocks assessed with backward methods (e.g. extended survivor analysis (XSA)). Special attention has been given to priority stocks agreed upon by the GFCM (as listed in Table 1; some non-indigenous species listed in Table 3 are also considered priority species but, since no assessment is yet available, they are not included in this chapter) 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. In addition, for the first time, attention is given to the evaluation of the status of populations of red coral (*Corallium rubrum*), which is also a GFCM priority species (Box 15). Finally, the difficult period of time we are living through has prompted an evaluation of the COVID-19 pandemic, whose impacts, along with lessons learnt and expected actions in response to the crisis, are summarized in Box 16.

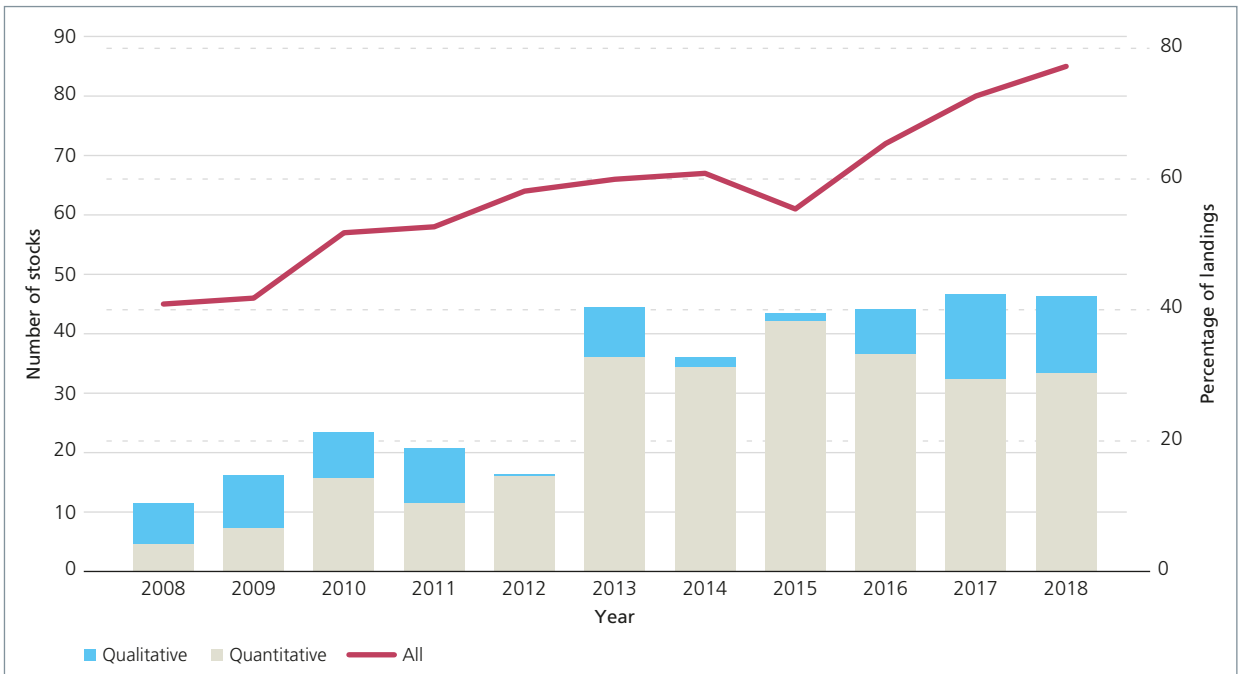
TABLE 12. Number of validated and non-deprecated stock assessments available per year, 2003–2018

Year	Validated stock assessments	Non-deprecated stock assessments
2003	1	1
2006	17	18
2007	27	32
2008	32	45
2009	28	46
2010	37	57
2011	25	58
2012	36	64
2013	29	66
2014	25	67
2015	38	61
2016	57	72
2017	57	80
2018	53	85

SPATIAL AND TEMPORAL COVERAGE OF ADVICE ON STOCK STATUS

The number of non-deprecated validated stocks increased progressively between 2006 and 2018, peaking in 2018 with 85 in total; of these, since 2016, more than 60 percent were carried out in the terminal year (i.e. less than 40 percent of the assessments used are more than one year old) (Table 12). Following a significant surge of validated assessments between 2010 and 2016, the percentage of catch assessed by the SAC and the Working Group on the Black Sea further increased in 2017–2018 (Figure 73). This situation is indicative of both an increase in the number of stocks validated and the fact that stocks with significant catch are being currently assessed – e.g. the Black Sea anchovy (*Engraulis encrasicolus ponticus*), whose annual landings are in the range of 200 000 tonnes. The dip in the percentage of landings assessed in 2014 (Table 12)

FIGURE 73. Number of stock units and percentage of declared landings assessed per year, 2008–2018, with an indication of the quality of the advice (i.e. qualitative vs quantitative) emerging from the assessments



Notes: The red line represents the number of stock units and the bar chart represents the percentage of declared landings assessed per year. Stock units are defined as a combination of 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.
Qualitative advice: providing validated advice on a precautionary basis, with no quantitative point estimates.
Quantitative advice: advice based on quantitative estimates generated by the assessments in terms of current fishing mortality and/or biomass and respective reference points.

FIGURE 74. Number of validated stock assessments per year by GFCM subregion, 2008–2018

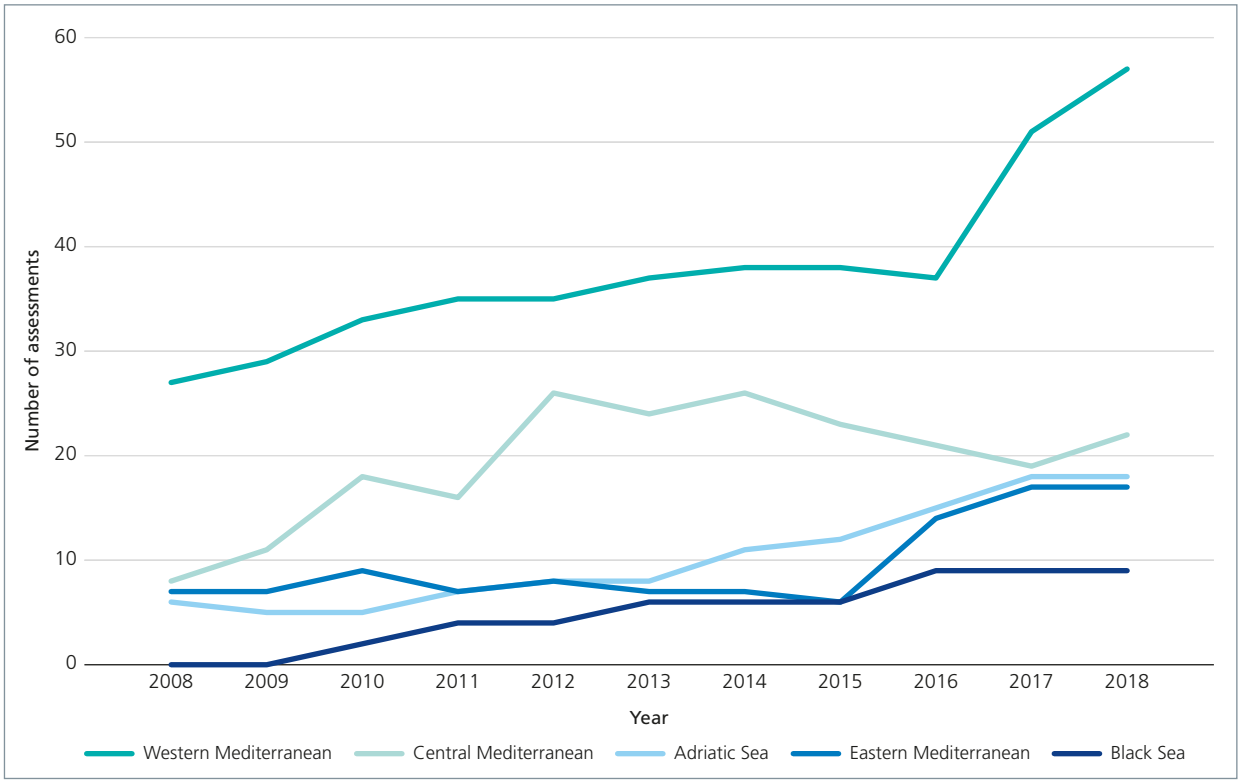
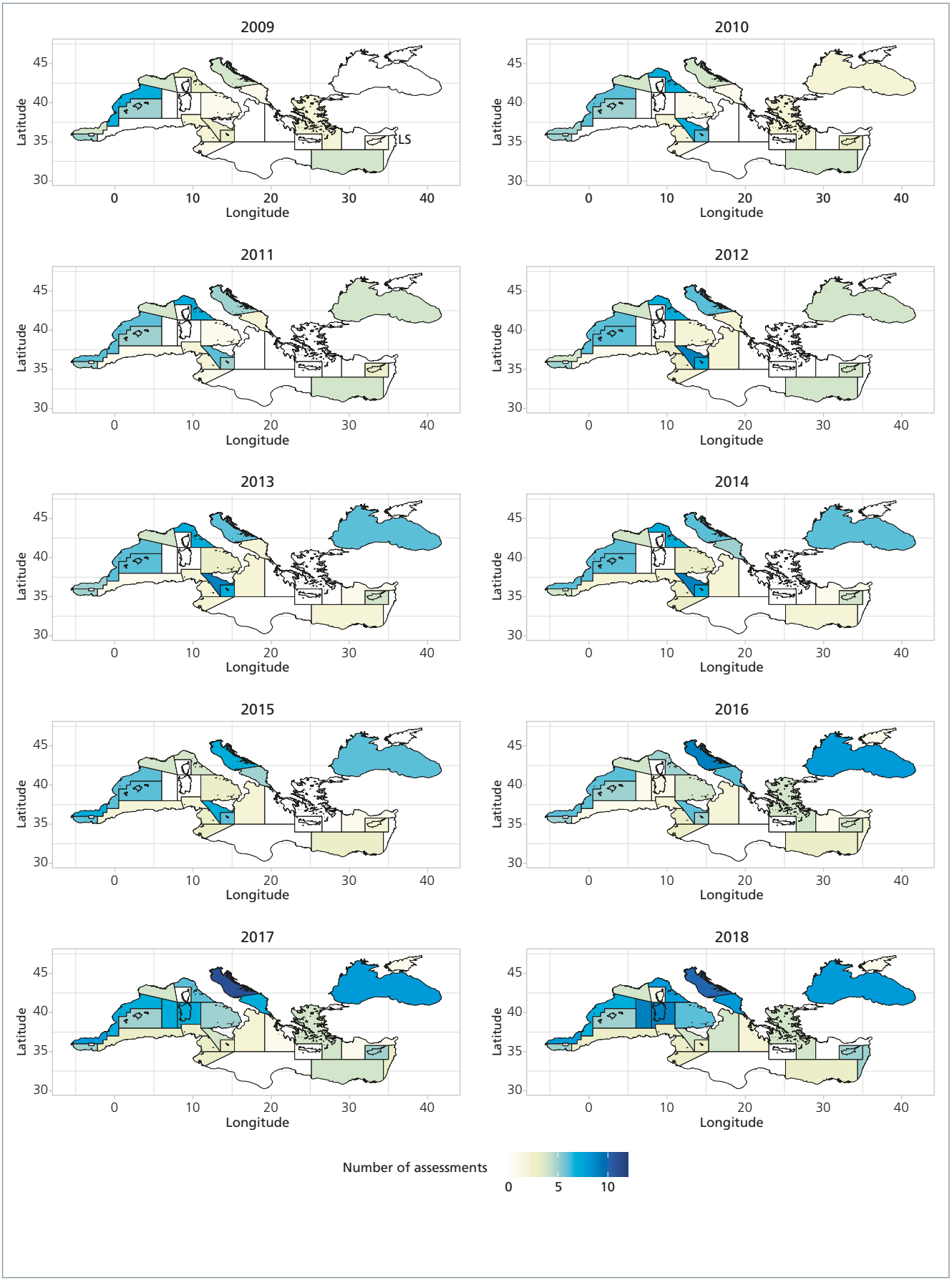


FIGURE 75. Number of validated stock assessments per year by geograhical subarea, 2009–2018



is linked to fluctuations in the catch of the small pelagic stocks assessed, particularly the Black Sea anchovy, which contribute importantly to total landings (Figure 73). The number of stocks for which advice was provided on a qualitative (precautionary) basis increased importantly in 2017–2018, from under 10 percent in 2016 to over 20 percent in 2018 (Figure 73). Contrary to what may be expected, this shift occurs in parallel with an improvement in the quality of advice and in the standards adopted by the Working Groups on Stock Assessment and the Subregional Group on Stock Assessment in the Black Sea in evaluating the presented assessments, based on a number of factors, mostly related to the quality of input data.

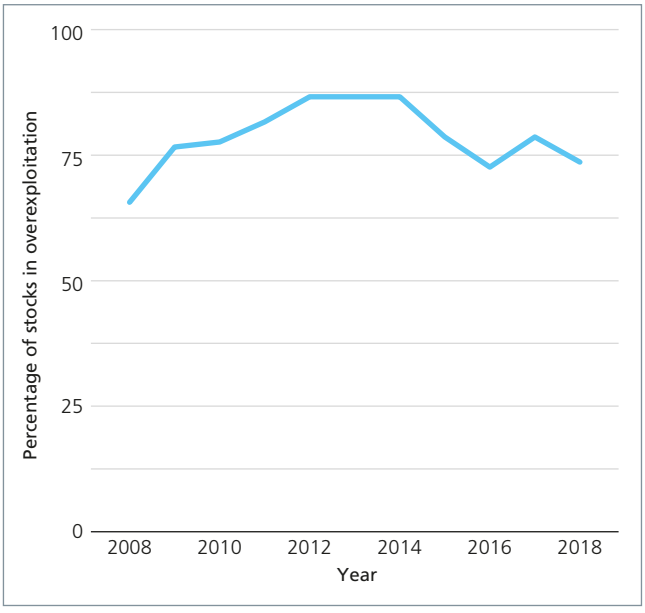
Although the overall increase in validated assessments compared to 2016 appears to be clearly reflected geographically, wide differences continue to occur in their spatial distribution (Figure 74). The western Mediterranean showed the steepest increase in the number of validated assessments since 2016 (Figure 74), although the degree of increase still varied between geographical subareas (GSAs) in the subregion (Figure 75); notably, coverage increased visibly in GSAs 1 (northern Alboran Sea), 4 (Algeria), 9 (Ligurian Sea and northern Tyrrhenian Sea), 10 (southern and central Tyrrhenian Sea) and 11 (western Sardinia, eastern Sardinia), and in 2018, GSA 8 (Corsica) was assessed for the first time since 2009 (Figure 75). Coverage in the Adriatic Sea and the eastern Mediterranean GSAs further increased since 2016, notably in GSAs 26 (southern Levant Sea) and 27 (eastern Levant Sea), although assessments are still missing for GSAs 23 (Crete) and 24 (northern Levant Sea) (Figure 74 and Figure 75). The number of validated assessments in the central Mediterranean was relatively stable over the most recent two years, with a slight increase in 2018 (Figure 74): validated assessments increased in GSA 19 (western Ionian Sea) and new ones were performed in GSA 20 (eastern Ionian Sea), although coverage of GSA 21 (southern Ionian Sea) is still null (Figure 75). The Black Sea (GSA 29)[1] is stable at eight assessments per year, regularly reaching the maximum number of validated assessments of priority species possible in a single year (Figure 74 and Figure 75).

Coverage varied geographically for the different priority species. For European hake (*Merluccius merluccius*) and red mullet (*Mullus barbatus*), recent assessments exist for most management units, with coverage having improved since 2016, although it is still incomplete for European hake in the eastern Mediterranean. Deep-water rose shrimp (*Parapenaeus longirostris*) also experiences excellent coverage in those subregions where it is a priority species, with few exceptions. While the number of assessments carried out for the main small pelagic species has increased, the coverage in the eastern and central Mediterranean, with the exception of the Aegean Sea, should be improved. Other species that could benefit from an increase in assessments (Table 13) include the two deep-water red shrimp species (the blue and red shrimp, *Aristeus antennatus*, and the giant red shrimp, *Aristaeomorpha foliacea*), towards which work is being currently carried out in the central and eastern Mediterranean subregions.

OVERVIEW OF STATUS OF STOCKS IN THE MEDITERRANEAN AND THE BLACK SEA

Most stocks for which validated assessments are available continue to be fished outside biologically sustainable limits (Figure 76). Nevertheless, recent trends continue to show a consistent

FIGURE 76. Percentage of stocks in overexploitation in the GFCM area of application, 2008–2018



[1] Stock assessments are not available for GSA 28 (Marmara Sea), therefore in this chapter Black Sea refers only to GSA 29.

TABLE 13. Year of the latest validated stock assessment by priority species and geographical subarea

	Western Mediterranean											Central Mediterranean					Adriatic Sea		Eastern Mediterranean								Black Sea		
	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
Demersal species																														
European hake	2018		2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018	2018		2018				2017				
Red mullet	2018		2014	2014	2012	2018	2018		2018	2018		2018	2018	2018	2017	2018	2018	2018	2018	2018		2018		2013	2015				2017	
Deep-water rose shrimp	2018		2017	2017	2016	2018			2018	2018	2018	2017	2017	2017	2017	2017	2018	2018	2018											
Blue and red shrimp	2018	2017			2016	2018			2018	2018	2018																			
Norway lobster					2017	2018			2018						2012	2012	2018	2018												
Giant red shrimp									2018	2018	2018							2018	2018											
Spottail mantis shrimp																	2018	2017												
Common sole																	2018									2007				
Blackspot seabream	2017		2017																											
Common cuttlefish																	2018													
Turbot																													2018	
Whiting																													2017	
Rapa whelk																													2017	
Pelagic species																														
European anchovy	2017					2018	2019		2018							2012	2018	2018				2018							2017	2016
Sardine	2018		2018			2018	2019									2017	2018	2018				2018								
Mediterranean horse mackerel																													2017	
European sprat																													2017	
Round sardinella																											2016			
Species of regional importance																														
Common dolphinfish																														
Species of conservation concern																														
Piked dogfish																													2017	
European eel																														
Red coral						2003																								

Note: Not all combinations of species and GSAs are considered as priority (see Table 1 and Table 3).

decrease of stocks in overexploitation, especially since 2014, when the percentage of stocks in overexploitation was 88 percent (in 2018, they were estimated at 75 percent) (Figure 76). The increased scrutiny applied to the relevant input data and the assessments themselves, following the introduction of the benchmarking process (Box 14), has led to a decrease in the number of assessments providing quantitative advice. At the same time, these assessments have experienced improvements in quality and have been accompanied by an increase in precautionary advice based on the trends observed. This result, coupled with the increase in the overall number of stocks assessed, is reflected in an apparent stabilization of the declining trend in the percentage of stocks in overexploitation, as shown in the data analyses carried out on fishing mortality and biomass below (Figure 77 and Figure 78).

Biomass reference points are not commonly available for assessed stocks; therefore, the percentage of stocks fished outside biologically sustainable limits is mainly estimated from the level of fishing mortality in relation to the fishing mortality reference point.

Box 14. Benchmarking process and changes in providing advice on the status of fishery resources

The steadily increasing number of stock assessments performed annually (Table 12, Figure 73) and the urgent need to achieve commonly agreed-upon sustainability goals for Mediterranean and Black Sea stocks call for further assurance of the assessments' quality while optimizing the time dedicated to each.

In order to address both issues, the forty-second session of the GFCM (FAO, 2019c) endorsed a process for benchmarking stock assessments.

A benchmark assessment is thereby defined as a complete analysis and review of all the information and methods currently used to provide advice on the status of a given stock, taking into consideration old and new data sources, as well as new or improved assessment models and assumptions. In particular, the benchmark process includes: the identification of all issues associated with past and current assessments, including data, assumptions and methodologies; the identification and provision of additional data to address the aforementioned issues; revising and agreeing upon data, assumptions and assessment methods; performing the assessment; the estimation of reference points; and the formulation of advice on the status of the stocks.

Benchmark sessions are attended by stock/fishery experts, as well as stock assessment methodology experts, both from the relevant area or GFCM subregion and from outside the GFCM area of application, including external reviewers, thus providing a framework to ensure the quality of the advice produced. Following the benchmark session, all historical data, assumptions and models will be fixed for the successive three to four years, while assessments carried out over this time period will simply provide updates incorporating data from the most recent year(s), thereby relieving the relevant working groups from needing to perform further analysis.

The schedule of benchmark assessments is agreed upon each year by the Scientific Advisory Committee on Fisheries (SAC) and the Working Group on the Black Sea (WGBS). Benchmarks are carried out separately from the plenary working groups on stock assessment and the Subregional Group on Stock Assessment in the Black Sea, allowing for the interval between advice on stock status and management advice to be shortened, ensuring that, if possible, they are based on the most recent data year possible.

The increase in coverage and the introduction of benchmarks revealed a number of shortcomings in the framework for the provision of advice endorsed in 2014 and underlined the need to adopt a process able to produce advice under different conditions of data availability. In order to tackle this appropriately, the forty-third session of the GFCM (FAO, 2020b) agreed to launch a process for revising and updating such a framework in order to include indications on specific advice for stocks having: i) both quantitative assessments and management strategy evaluations, in which case alternative management measures should be evaluated; ii) quantitative assessments, in which case short-term forecasts should be used; and iii) no quantitative assessments, in which case precautionary advice should be provided.

GFCM benchmark assessments carried out thus far are listed in the following table.

(cont.)

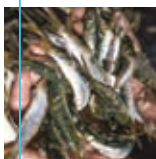
Box 14. (continued)

GFCM benchmark assessments carried out by the GFCM

Benchmark	Date	GSAs assessed	Validated	Reference year	Data year compared to advice year
Red mullet in the central Mediterranean	19–21 November 2018	12–13–14	21st SAC session (2019)	2017	n-2
		15			
		16			
		19			
European sprat in the Black Sea	27–28 November 2018	29	9th WGBS session (2019)	2017	n-2
European hake in the Adriatic Sea	17–18 January 2019	17–18	21st SAC session (2019)	2017	n-2
Blackspot seabream in the Strait of Gibraltar	1–4 April 2019	1–3	Finalized but not yet validated	2017	(n-2)
Turbot in the Black Sea	8–12 July 2019; 16–17 September 2019	29	9th WGBS session (2019)	2018	n-1
Anchovy in the Adriatic Sea	13–16 May 2019 July-November 2020	17–18	Finalized but not yet validated	2019	(n-1)
Sardine in the Adriatic Sea		17–18	Advice provided, benchmark not finalized	2019	(n-1)
European hake in the Mediterranean	2–7 December 2019	1–5–6–7	Finalized but not yet validated (COVID-19)	2018	n-2
		1–3	Advice provided, benchmark not finalized		
		4	Not finalized (precautionary advice)		
		8–9–10–11	Finalized but not yet validated (COVID-19)		
		12–13–14–15–16			
		19			
		20	Precautionary advice provided, benchmark not finalized		
		22			
		23			
		26			
Sardine in the Alboran Sea	10–14 December 2019	1	Finalized but not yet validated (COVID-19)	2018	n-2
		3			
		4	Not finalized (preliminary advice)		

TABLE 14. Exploitation ratio (F/F_{MSY}) by priority species and geographical subarea, with average value per species

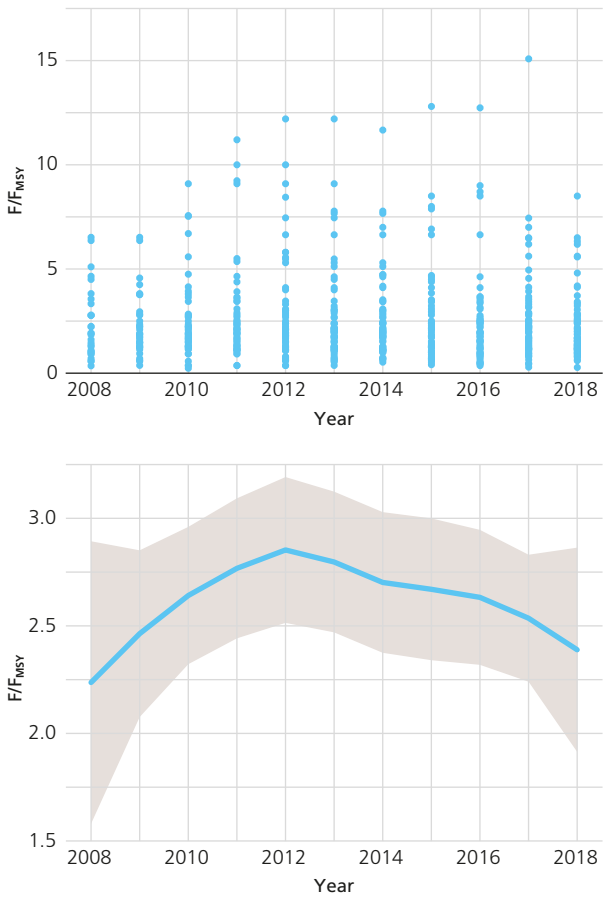
	Western Mediterranean											Central Mediterranean								Adriatic Sea		Eastern Mediterranean						Black Sea			Mean
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	19	20	21	17	18	22	23	24	25	26	27	28	29	30	
Demersal species																															
European hake	5.58		8.50	6.50	5.58	5.58	5.58	4.19	4.19	4.19	4.19	1.66	1.66	1.66	1.66	1.66	2.38			2.78	2.78					4.12					3.92
Red mullet	6.33		3.42	3.42		4.81	1.32		2.72	1.17		2.00	2.00	2.00	1.20	0.76	1.27	0.27		1.11	1.11	0.6			0.81						2.02
Deep-water rose shrimp	1.17		2.14	2.14	1.14	1.36			0.95	0.95	0.95	1.69	1.69	1.69	1.69	1.69	3.34			3.34	3.34										1.83
Blue and red shrimp	1.42	1.4			2.00	6.18			3.72	3.72	3.72																				3.17
Norway lobster					5.62	1.00			1.55											1.58	1.58										2.27
Giant red shrimp									3.04	3.04	3.04						1.10				1.10										2.26
Spottail mantis shrimp																				1.53	2.54										2.04
Common sole																				1.02											1.02
Blackspot seabream	1.70		1.70																												1.70
Common cuttlefish																				0.89											0.89
Turbot																													2.20		2.20
Whiting																															
Rapa whelk																															
Pelagic species																															
European anchovy																				1.69	1.69								1.33	0.95	1.42
Sardine	2.62		1.86			1.25														3.23	3.23										2.44
Mediterranean horse mackerel																															
European sprat																															
Round sardinella																															
Species of regional importance																															
Common dolphinfish																															
Species of conservation concern																															
Piked dogfish																															
European eel																															
Red coral																															



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 (Table 14). A clear, though not significant, decreasing trend has been seen in their average exploitation ratio (current fishing mortality over target fishing mortality, F/F_{MSY}) since 2012 (Figure 77). A wide range of exploitation ratio estimates are observed around the average and are trending towards lower values in recent years (Figure 77). The highest maximum values of exploitation ratios are found with European hake, followed by blue and red shrimp and Norway lobster (*Nephrops norvegicus*), while in terms of highest average values, European hake and blue and red shrimp are followed by sardine (*Sardina pilchardus*) (Table 14). Nevertheless, European hake provides the strongest indication of improvement in both maximum and average exploitation ratios, showing a 30 percent decrease since the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018). Stocks fished within biologically sustainable limits (i.e. with exploitation ratios below 1) include anchovy, common cuttlefish (*Sepia officinalis*), Norway lobster and red mullet, as well as deep-water rose shrimp in certain GSAs (Table 14).

FIGURE 77. Exploitation ratios (F/F_{MSY}) of all species and management units, 2008–2018

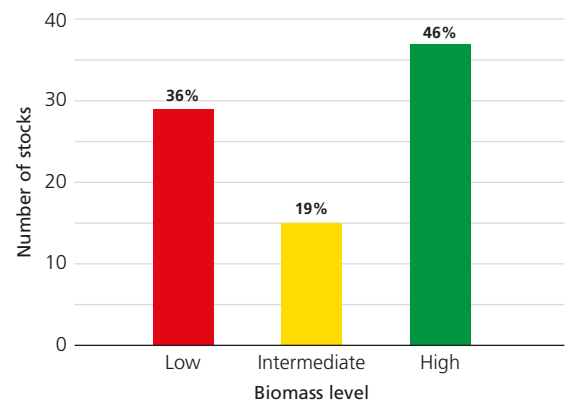


Note: The top panel shows individual stock assessments per year; the bottom panel shows the average trend (using LOESS smoother), with the shaded area representing the standard error.

Overall status of stocks: biomass

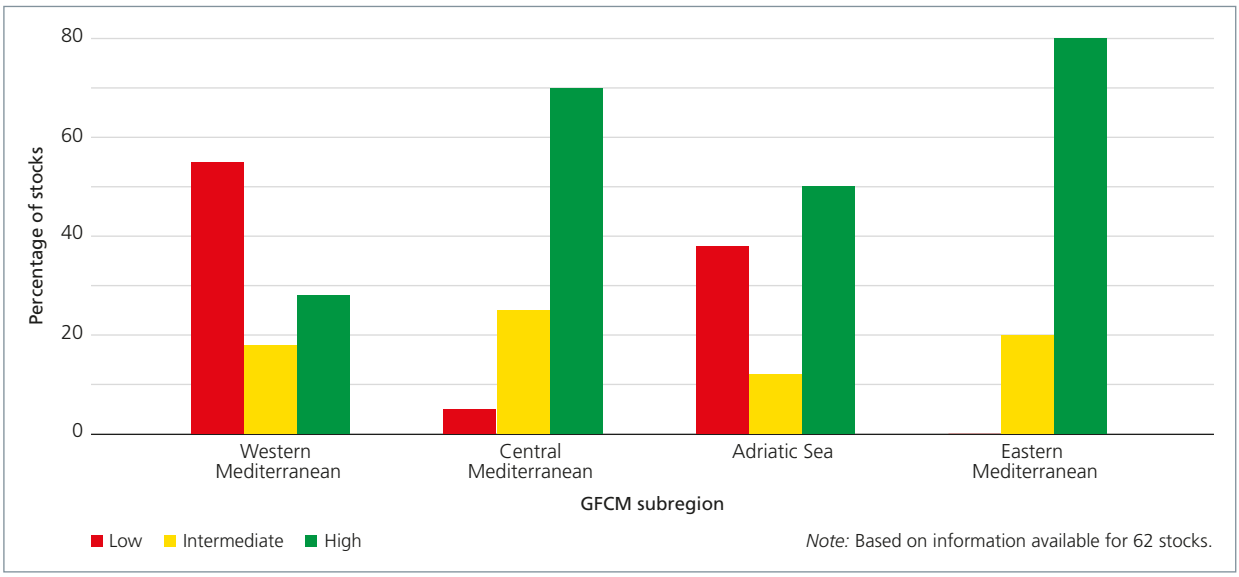
As in previous years, although continuing to improve, scientific advice on the status of resources in relation to biomass is scarcer than advice with respect to fishing mortality. This difference is mainly due to a lack of biomass reference points, which in turn reflects an uncertainty in the absolute 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 82 stocks, representing a 30 percent increase compared with 2016. With few exceptions, the biomass of all demersal species is classified as high, intermediate or low by comparing the current estimate with the 66th and 33rd percentiles of the available time series. For red mullet in GSA 20 (eastern Ionian Sea) and GSA 22 (Aegean Sea), caramote prawn (*Melicertus kerathurus*) in GSA 17 (northern Adriatic Sea), Norway lobster in GSAs 17–18 (northern and southern Adriatic Sea) and common pandora (*Pagellus erythrinus*) in

FIGURE 78. Number and percentage of Mediterranean stocks at low, intermediate and high biomass levels



Note: Based on information available for 62 stocks covering 20 GSAs and 14 species.

FIGURE 79. Percentage of Mediterranean stocks at low, intermediate and high biomass levels by GFCM subregion



GSA 25 (Cyprus), current biomass estimates were compared to the biomass at MSY (B_{MSY}) reference point. For European hake in GSAs 17–18 (northern and southern Adriatic Sea) and giant red shrimp in GSA 19 (western Ionian Sea), as well as for all small pelagic species except sardine in GSA 3 (southern Alboran Sea), the comparison was made with respect to the B_{PA} (precautionary reference point). For sardine in GSA 3 (southern Alboran Sea), B_{MSY} was used.

Advice in relation to biomass in the Black Sea was only provided on a regular basis for turbot (*Scophthalmus maximus*), for which B_{PA} was used and which resulted in an intermediate state of biomass in the most recent assessment year.

The analysis of the current biomass levels of Mediterranean stocks presents a striking improvement compared to 2016, with only 36 percent of the stocks considered to be at low biomass (11 percent decrease), 19 percent at intermediate biomass (12 percent decrease) and 46 percent with high biomass (23 percent increase) (Figure 78, Table 15).

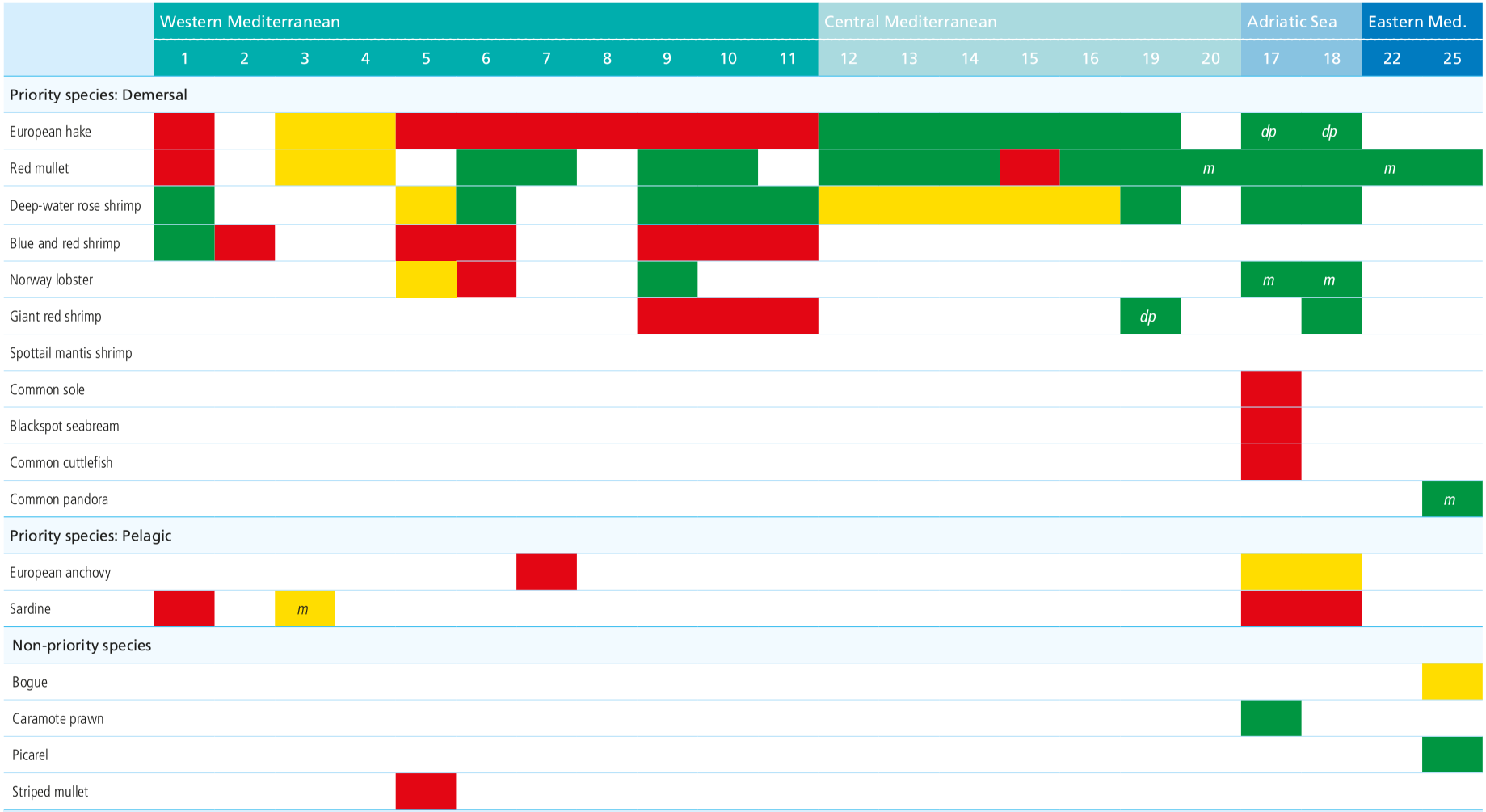
At the GFCM subregional level, it is evident that though the western Mediterranean still shows a prevalence of stocks with low biomass, its percentage of stocks with high biomass has increased at the expense of those with intermediate biomass and it represents the subregion with the highest number of stocks whose biomass can be assessed (n = 40). The percentage of stocks with high biomass increased significantly in all other subregions, particularly in the central Mediterranean, where the percentage of stocks with low biomass is around 5 percent, based on assessments of the biomass of 20 stocks. Sixteen stocks provided biomass information in the Adriatic Sea, of which 50 percent were considered to be at high biomass. The coverage in the eastern Mediterranean in terms of biomass remains low (five stocks), with 80 percent of them at high biomass levels (Figure 79, Table 15).

A more in-depth analysis of this overall improvement in biomass levels compared to the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2018) revealed that of the 18 stocks common to both reviews, ten remained at the same level of biomass, while for six (mostly red mullet and blue and red shrimp), biomass levels had improved and for two, they had declined (Figure 80; top). A large number of stocks analysed for biomass in the last two years were analysed in only one of the reviews; of these, the number of high biomass stocks was strikingly greater in 2020 (Figure 80; bottom).

Status and trends of priority species

Among pelagic stocks, the anchovy shows stability across the region, with a steady average since 2016 and a decrease (by 24 percent) in the maximum exploitation ratio in 2018 (Table 14, Figure 81). The average exploitation ratio of sardine, on the contrary, has been steadily increasing since 2010, even if the decrease in the maximum values

TABLE 15. Relative biomass level by priority species and geographical subarea in the Mediterranean Sea



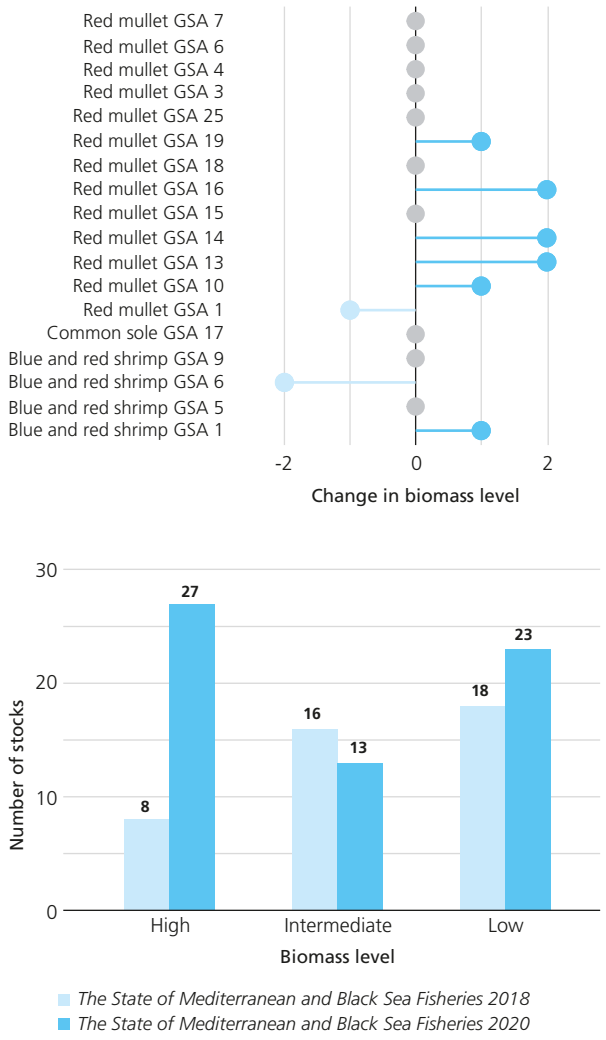
Notes:
Based on 81 validated stock assessments. Red indicates low biomass, yellow intermediate biomass, and green high biomass, estimated as follows:
- For pelagic species, biomass level was decided based on a comparison between the current estimate and the precautionary reference point (low: current biomass < B_{PA}; intermediate: current biomass > B_{PA}).
- For demersal species, biomass level was decided based on a comparison between the current estimate and the 33rd and 66th percentile of the time series (low: current biomass < 33rd percentile; intermediate: 66th percentile > current biomass > 33rd percentile; high: current biomass > 66th percentile).

Exceptions of these rules were as follows, due to available information:
- (dp): demersal species whose biomass level was decided as if it were a pelagic species.
- (m): species whose biomass level was decided based on a comparison between the current estimate and B_{MSY} (low: current biomass < B_{MSY}; high: current biomass > B_{MSY}).

recorded offers some optimism (Figure 81); the overall catch of this species has been decreasing since the mid-1980s but has stabilized around average to low levels in the past decade or so (see Figure 25). Among demersal species, decreasing trends in exploitation ratios by species are evident for European hake, red mullet, common sole and Black Sea turbot (Table 14, Figure 81), all of which provide evidence of a marked reversal in the negative trends previously observed. The catch of these four species shows that recent years have been characterized by relative stability (see Figure 25 and Figure 26). For European hake and red mullet, the maximum ratio recorded has also decreased importantly since 2016, by 30 percent and 26 percent respectively. Deep-water rose shrimp, like anchovy, shows a stability across the region (Figure 81), despite an impressive increase in the catch of the former, likely resulting in a change in availability of the species (see Figure 25). In contrast, blue and red shrimp (with increasing catch) and Norway lobster (with decreasing catch) show rather significant increases in their exploitation ratio over time, particularly since 2015 (Figure 81).

When the exploitation ratio and biomass level are combined for the main stocks of the two iconic species European hake and turbot, different pictures emerge. For European hake in the Tyrrhenian Sea (GSAs 8–11) and in the Strait of Sicily (GSAs 12–16), the overall decreasing trend in the exploitation ratio (F/F_{MSY}) is confirmed, while the expected corresponding increasing trend in biomass (B/B_{PA}) is less clear, suggesting some delay in the response of the stock to decreasing pressure. On the other hand, for turbot in the Black Sea (GSA 29), the promising trend observed up to 2016 is confirmed, with a continued steady decrease in F/F_{MSY} since 2014 and a marked increase in B/B_{PA} since 2014 (Figure 82).

FIGURE 80. Comparison of biomass levels between the previous and current editions of *The State of Mediterranean and Black Sea Fisheries*



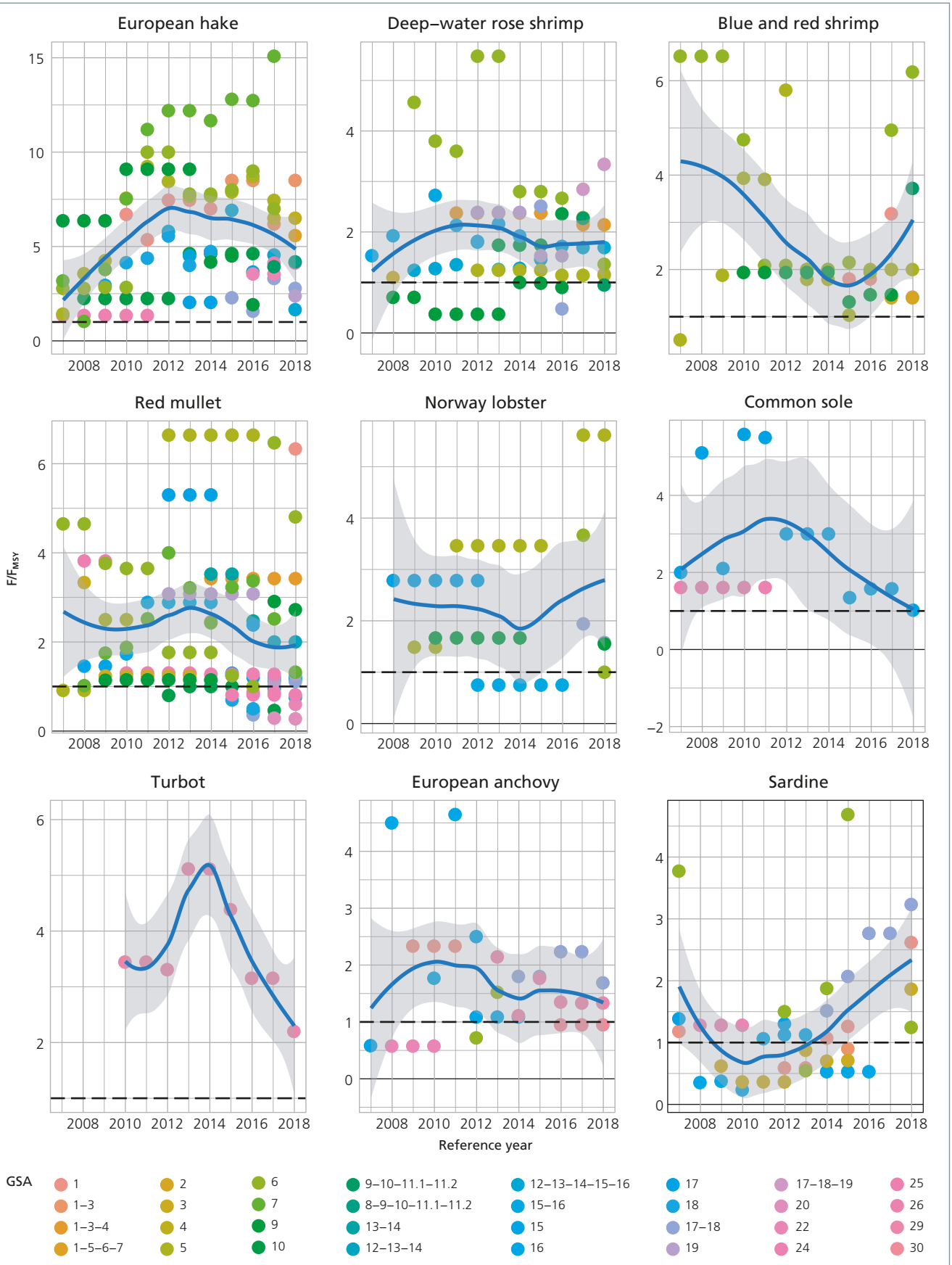
Notes:
Top panel: changes in biomass level of stocks common (n = 18) to both reviews; bottom panel: number of stocks that were not common to both reviews at each biomass level.
Low = 1, intermediate = 2, high = 3

FINAL REMARKS

The percentage of stocks with validated assessments has continued to increase in recent years, particularly in the western Mediterranean, as have the geographical coverage of assessments and the percentage of catch being assessed. As a result of the introduction of the benchmarking process in 2017, the quality of assessments has improved owing to greater scrutiny of the input data and the adoption of more stringent standards. Although this development has resulted in more assessments failing to meet standards, it has led to more advice being provided in qualitative terms. In parallel, significant work has been and is being carried out towards assessing data-limited stocks, as well as towards data collection. Nevertheless, efforts are still required to extend assessment coverage to all GSAs, particularly the eastern Mediterranean.

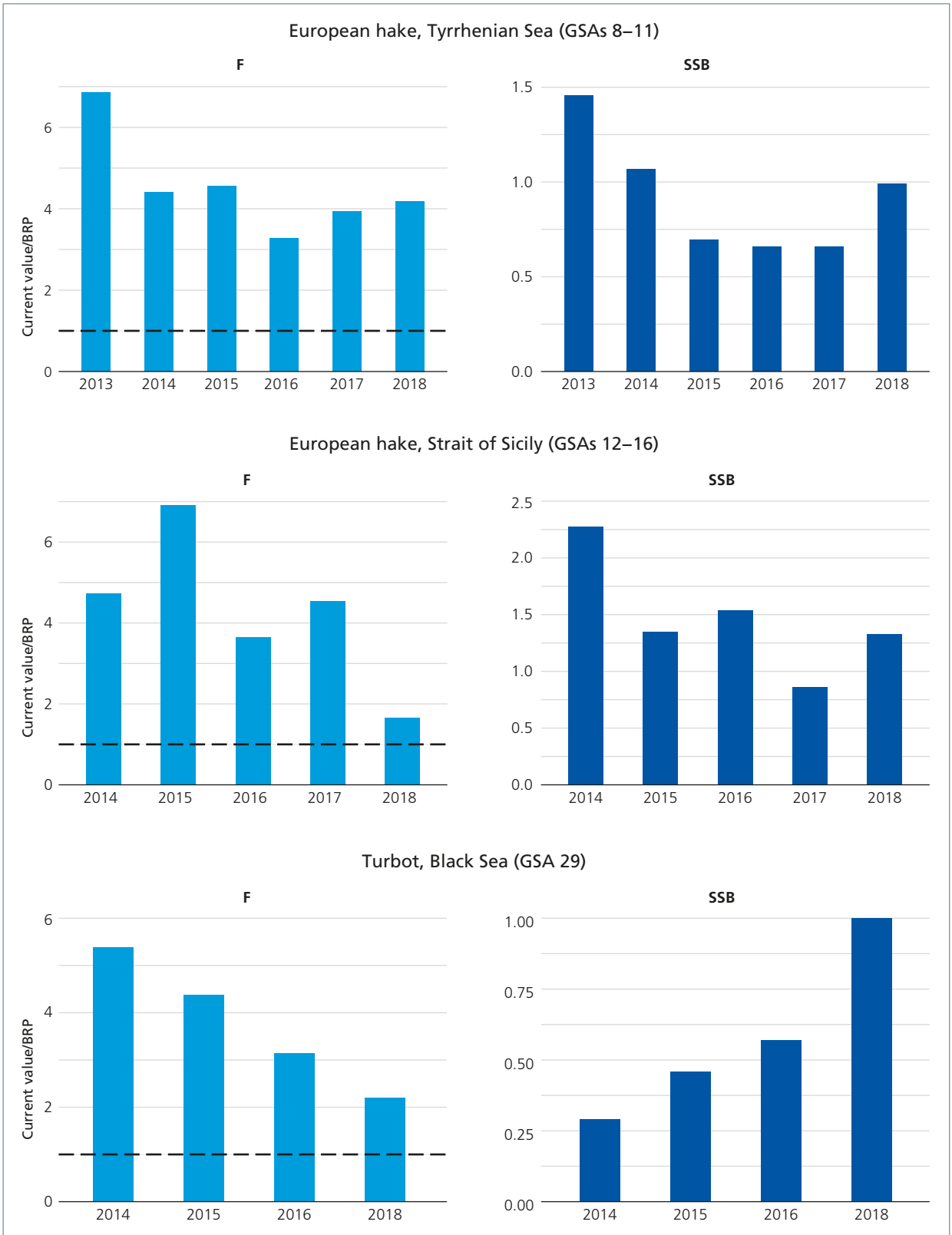
While most stocks remain in overexploitation, the number of stocks in overexploitation has further decreased, as has the overall exploitation

FIGURE 81. Trends in the overexploitation ratio (F/F_{MSY}) of select priority species, 2007–2018



Note: Trends are shown using LOESS smoother. The shaded area represents the standard error and the dashed line represents the exploitation ratio F/ F_{MSY} = 1."

FIGURE 82. Annual progression in biomass (B/B_{PA}) (right) and exploitation ratio (F/F_{MSY}) (left) for European hake in the Tyrrhenian Sea and the Strait of Sicily and for turbot in the Black Sea



Notes: BRP = biological reference point; F = fishing mortality; SSB = spawning stock biomass.
The dashed line represents $F/F_{MSY} = 1$; pending recalculation, reference points for turbot in 2018 represent an average of old and new reference points.
Biomass is expressed as spawning stock biomass.

Box 15. Status of the precious red coral in the Mediterranean Sea

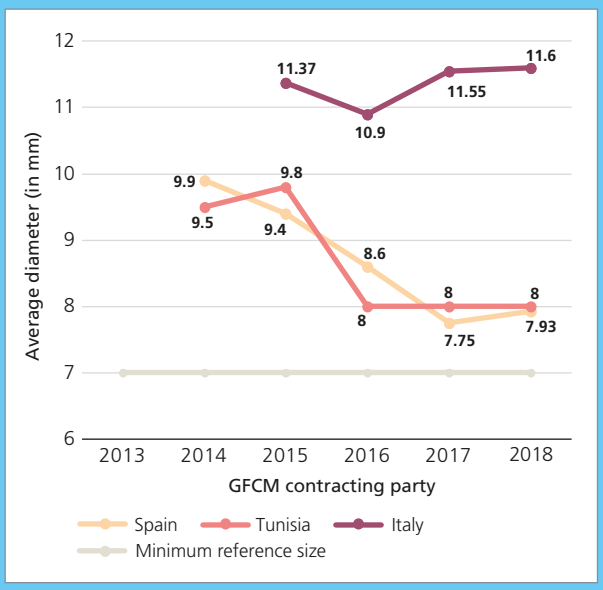
The term "precious corals" collectively describes those species of coral (species that belong to the Phylum Cnidaria and have a skeleton made of calcium carbonate or limestone) whose skeletal axis is used as a gemstone to make ornaments and jewellery. Eight species of the family Coralliidae, subclass Octocorallia, are currently used in this way. One of these species – red coral (*Corallium rubrum*) – is exploited in Mediterranean waters. Red coral is a sciaphilous species endemic to the Mediterranean and neighbouring Atlantic coasts and is found on rocky substrates from depths of 15 m to 800 m. Red coral is considered one of the most vulnerable resources in the Mediterranean Sea due to its longevity (it can live up to 100 years or more), slow growth, low fecundity, limited dispersal capabilities and consequently strong genetic differentiation between neighbouring populations at spatial scales of just a few kilometres.

The countries with a red coral fishery in the Mediterranean Sea are fewer than a dozen: Croatia, France, Greece, Italy, Spain and Tunisia exploit red coral under diverse national regulations (including the implementation of multiannual closures to allow for the recovery of exploited red coral banks), though in Greek waters, no harvesting activities have occurred in the last few years. In Algeria and Morocco, red coral fisheries are temporarily closed.

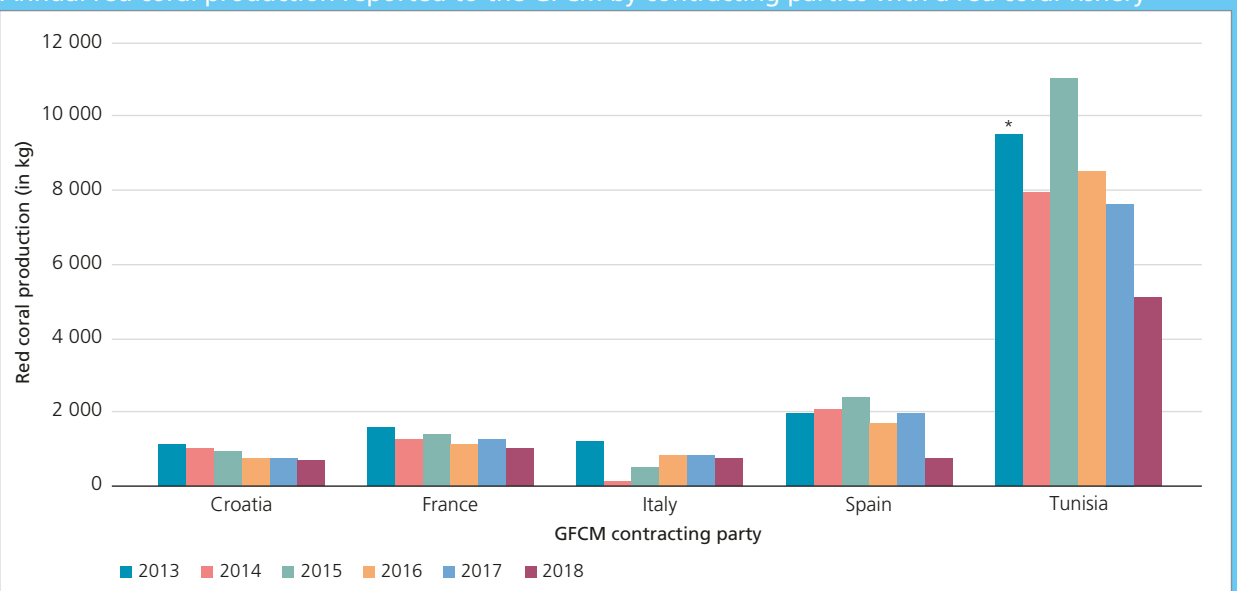
Considering the vulnerability of red coral, and the lack of a quantitative assessments on the status of the populations and their mortality due to fishing activities, red coral fisheries are currently managed by the GFCM under the framework of the precautionary and ecosystem approach to fisheries, by means of a series of conservation measures and reference indicators including:

- prohibition of harvesting red coral with gear other than a hammer used by a scuba diver;
- prohibition of harvesting (shallow) red coral populations at depths of less than 50 m;
- mandatory recording of catch by area and depth;

Average diameter of harvested red coral colonies reported to the GFCM by contracting parties with a red coral fishery



Annual red coral production reported to the GFCM by contracting parties with a red coral fishery



Notes: The values are based on production data officially submitted to the GFCM by relevant national authorities and therefore do not correspond to those included in the FAO global capture production statistics, which come from a wholesaler of major precious corals. *Estimate.

Box 15. (continued)

- monitoring that fishing effort does not increase;
- setting a minimum landing size (basal diameter must be greater than 7 mm) and requiring mandatory records of the weight of undersized colonies (with a 10 percent tolerance of undersized colonies in the overall catch weight);
- establishment of daily/annual quotas at the national level; and
- implementation of emergency measures, such as closure of the fishery, under identified circumstances.

The figures provided here report two red coral fishery indicators (annual production and average diameter of colonies) submitted from 2013 to 2018 to the GFCM by the countries involved. Data gaps exist in relation to the average diameter of the harvested colonies and the percentage of undersized colonies. Improving data quality seems fundamental in order to understand the actual "healthy" state of exploited red coral banks, as according to the available data from two of the main producers, red coral populations could be exploited outside biologically safe limits (based on the decrease in average diameter size of harvested colonies).

ratio for the whole Mediterranean and Black Sea region. This dynamic is reflected in marked improvements for a number of demersal species in terms of fishing mortality and, in some cases, of biomass too. Notable examples are provided by European hake and Black Sea turbot, as well as red mullet and common sole, most likely demonstrating the effectiveness of national and regional management measures, including overall effort reduction and the protection of coastal areas from trawlers. Conversely, sardine and blue and red shrimp have shown opposite trends: the reasons may lie in the overall lack of coverage and management measures for the former and the extremely high prices fetched by the latter, which sustain the incentive to overexploit it (see also the trends in catch shown in Chapter 2).

Interestingly, there is evidence that the improvement in the exploitation ratio observed for Black Sea turbot is matched by an increase in biomass, which was also predicted by the simulations performed within a management strategy evaluation framework summarized in the previous edition *of The State of Mediterranean and Black Sea Fisheries* (FAO, 2018). In contrast, the decrease in the exploitation ratio observed for a number of hake stocks (e.g. in the Tyrrhenian Sea and the Strait of Sicily) are not matched so closely by corresponding increases in biomass; this situation not only reflects the different biological characteristics of the two species but also serves as an important reminder that early signs of reversing the trend should not be taken for granted.

The positive signs provided by this overall analysis are indicative of an inversion in the trend of overexploitation in the Mediterranean and Black Sea, particularly for demersal resources. Both an increase in quality and coverage of stock assessments and reversals in the trends in stock status are found within the main objectives of the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries. In line with the conceptual framework of the strategy, the increase in coverage and quality of advice, including a reduced time lag between the reference year of the data and its corresponding advice, has been accompanied by the adoption of a significant number of national and regional management measures in the past five years or so (see Chapter 7). These measures include the adoption of incipient plans leading to improvements in the management of fishing activities, including through effort control and/or the introduction of quota-based management for some species, as well as the establishment of fisheries restricted areas and spatio-temporal measures to protect essential habitats and life-stages. It will be crucial to maintain this reversing momentum through a synergy of effective harvest control rules, other measures for the management of catch and fishing effort (in numbers, in space and over time) and a reinforcement of the self-control already demonstrated by some fisheries.

Box 16. The COVID-19 pandemic and its impacts on Mediterranean and Black Sea fisheries

Since early March 2020, as it spread around the planet, the COVID-19 pandemic has severely disrupted business as usual in the Mediterranean and Black Sea region. While measures taken by contracting parties and cooperating non-contracting parties (CPCs) to contain the rate of infection – such as social distancing, business closures and travel bans – have had important impacts on the fishing sector's ability to catch and market fish, the pandemic has also affected fisheries management, control and research activities.

In order to better understand the impact of the COVID-19 crisis on fisheries in the region, the GFCM carried out a series of activities to build and share knowledge among its CPCs. Two analyses were published by the GFCM Secretariat, the first detailing the impacts of early lockdown measures (GFCM, 2020b), and the second assessing the evolution of the situation a few months into the crisis (GFCM, 2020c). Following the publication of these analyses, the GFCM also held an Online Forum (GFCM, 2020d) in June–July 2020, with a view to facilitating a reflection on how to better support the sector's resilience moving forward.

The analyses carried out showed that Mediterranean and Black Sea fisheries initially underwent dramatic changes due to the COVID-19 pandemic. For example, a reduction in operating vessels of up to 80 percent was observed in some CPCs, as well as an initial decrease in production of around 75 percent. Fish market prices also decreased between 20 and 70 percent duringthis initial phase, particularly for species typically destined to the hotel, restaurant and catering sector (HoReCa), such as seabass (*Dicentrarchus labrax*) and turbot (*Scophthalmus maximus*). Furthermore, restrictions on the movement of people and goods across borders had an immediate impact, particularly on those CPCs where a significant portion of the catch is destined for export to international markets (see Chapter 3) and on certain fleet segment groups with a high reliance on foreign labour. In some cases, fishers were quick to adapt to the changing conditions, by shortening value chains and selling catch via direct sale and e-commerce, for example, or by switching target species in order to catch species destined for local markets or those that could be frozen, canned or otherwise processed and sold at a later date. Due to this adaptability, as well as measures put in place by governments, the dramatic early impacts began fading towards summer of 2020 and, in many CPCs, production returned to pre-crisis levels. Nevertheless, demand has remained volatile throughout 2020 and uncertainty persists over the longer-term economic outlook.

Considering the strong reduction in fishing effort during the very initial phase of the pandemic, some hypothesized that it may have (at least temporarily) reduced pressure on resources and the environment. While some fast responses in coastal ecosystems, such as an increase in the presence of marine mammals close to the coast or the immediate reduction of turbulence in Venice's canals, were perceived as positive reactions, it is too early to tell if there may be any significant medium- to long-term effects on ecosystems or fish stocks. Furthermore, the pandemic has affected the ability of fisheries scientists to collect data in the field, with potential impacts on the quality and quantity of data available for assessments. The pandemic has, however, provided clear evidence that anthropogenic activities put significant pressure on marine ecosystems, including through the displacement of marine animals from parts of their habitats and increased turbulence and noise. Moreover, marine pollution remains high and the observed increase in the use of single-use plastic packaging, masks, gloves and other litter associated with the pandemic may also have some impacts over the short, medium or long term.

	Impacts	Contributing factors
	- Up to 80 percent of vessels not operating in the first weeks of the crisis, although most have since returned	**Physical restrictions** - Difficulty in complying with social distancing restrictions, particularly onboard small-scale fisheries - Border closures preventing the transport of products (closure of export markets - Closure of fishmongers and local markets
	- Initial decrease in production of more than 75 percent in most countries, although pre-crisis production levels have since returned in some countries	
	- An initial 20–70 percent decline in prices - Certain species more acutely affected (e.g. shellfish, seabass and seabream, turbot) due to restaurant closures	**Major changes in demand** - Closure of HoReCa sector - Changes in consumer preferences towards cheaper/canned products - Temporary oversupply of fresh fish - Limited international tourism during high-season

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PART 2

Management of Mediterranean and Black Sea fisheries

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

Small-scale fisheries (SSF) are a crucial subsector of fisheries in the Mediterranean and Black Sea region, representing 83 percent of the fleet, 57 percent of employment onboard vessels, 29 percent of revenue and 15 percent of catch, as highlighted in Chapters 1, 2 and 3. Furthermore, SSF serve an important role in coastal communities around the region, creating additional jobs up and down the value chain, promoting food security by providing a fresh and healthy source of protein, and preserving cultural and culinary heritage for the benefit of tourism and restaurant industries. Yet this sector remains data poor, hindering its proper consideration in decision-making processes. While SSF data collection is improving in line with the objectives of the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries, the sector still lacks, in many cases, regular data collection to monitor its biological and ecological impacts, as well as data that fully capture its social and economic benefits. In particular, little information is available on

gleaning (i.e. shore-based shellfish collecting) and other shore-based SSF activities, as well as on the activities of fish workers (i.e. shore-based workers) operating in the pre- and post-harvest sectors; these are all areas with considerable contribution from women. Furthermore, small-scale fishers remain a highly vulnerable group, often with limited access to social protection programmes and financial services, thus hindering their capacity to respond to, or plan for, adverse events.

In recognition of the essential role and potential of the SSF sector, as well as of the challenges it faces, ministers and high-level representatives of Mediterranean and Black Sea countries came together in 2018 to sign a ministerial declaration committing to implement a ten-year Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF). The RPOA-SSF established the objectives, principles and concrete actions to be applied in order to ensure the long-term environmental, economic and social sustainability of SSF in the region. Among the many objectives of this declaration, the RPOA-SSF seeks to amplify the voices of small-scale fishers and other relevant stakeholders within decision-making processes.

This chapter reviews the state of the SSF sector with respect to key topics in the RPOA-SSF and details the process of implementing the RPOA-SSF. The chapter first describes efforts underway to track the implementation of the RPOA-SSF through a monitoring framework. The main themes among the RPOA-SSF's objectives are then reviewed, namely, improving the characterization of SSF, supporting the science-policy interface for SSF, promoting sustainable SSF livelihoods and social development, and empowering small-scale fishery stakeholders. In line with each of these main themes, baseline information on the state of the SSF sector at the beginning of the RPOA-SSF implementation period is provided and priority actions to be implemented over the short term to advance towards the RPOA-SSF's objectives are described.

MONITORING PROGRESS IN THE IMPLEMENTATION OF THE REGIONAL PLAN OF ACTION FOR SMALL-SCALE FISHERIES

As a first step following the RPOA-SSF adoption, a monitoring framework for its implementation through 2028 was prepared in coordination with the Friends of SSF platform[10]. The monitoring framework analysed the actions prescribed by the RPOA-SSF, seeking to identify actions to be prioritized for implementation over the short term, as well as key indicators to track the status of implementation and guide progress towards achieving the overall long-term objectives.

After its initial development, the monitoring framework was subject to a participatory consultation process in order to provide an opportunity for all relevant stakeholders, including fisher representatives, to provide further input and contribute to refining its contents. The monitoring framework was presented to, and discussed by, relevant GFCM technical bodies, namely, at the second meeting of the Working Group on Small-Scale Fisheries (WGSSF) (GFCM, 2019b) and subsequently at the subregional committees and the Scientific Advisory Committee on Fisheries. It was also discussed during a workshop on "Advancing social development for the future of small-scale fisheries in the Mediterranean and the Black Sea" (GFCM, 2019c), as well as shared widely among relevant stakeholders, allowing for inputs to be submitted electronically. A revised version of the monitoring framework was then presented to the forty-third session of the GFCM, where it was endorsed. Noting that, for certain indicators proposed within the monitoring framework, little information was available at the regional level to assess the baseline status of implementation, the GFCM also endorsed a questionnaire to assess the status quo and gaps in knowledge (RPOA-SSF monitoring framework questionnaire; Box 17).

[10] The Friends of Small-Scale Fisheries platform is a regional network of actors sharing common interests and objectives for the sector. The platform aims to promote transnational cooperation and build synergies among ongoing work in the region and it plays an integral role in the implementation of the RPOA-SSF.

Box 17. Collecting information on Mediterranean and Black Sea small-scale fisheries

The Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF) monitoring framework questionnaire was designed to collect relevant information, not otherwise available, to assess the status of implementation of the RPOA-SSF, in line with the monitoring framework developed. The questionnaire included 18 questions on topics ranging from how small-scale fisheries (SSF) are characterized at a national level, to data collection and data reporting obligations, available services at landing sites, access to social protection programmes and engagement of SSF stakeholders in decision-making processes. Questions were developed whose answers could shed light on the key issues in line with the subsections of the RPOA-SSF, namely:

- Characterization of SSF
- Scientific research
- SSF data
- SSF management measures
- Value chain
- Participation of SSF in decision-making processes
- Capacity development
- Decent work
- Role of women
- Climate and environment

This questionnaire was circulated in 2019 to the GFCM focal points of all contracting parties and cooperating non-contracting parties (CPCs) with SSF operating in the Mediterranean and the Black Sea (26 CPCs). In total, 22 CPCs responded, although some CPCs did not respond to every question within the questionnaire, due to a lack of available information. Based on the responses received, baseline information for each indicator identified in the monitoring framework was calculated and the results are reported in this chapter. Percentages are calculated based on the total number of CPCs responding to the question.

The monitoring framework questionnaire is expected to be re-circulated to CPCs in advance of key milestones over the course of the ten-year implementation of the RPOA-SSF (e.g. the mid-term conference foreseen in 2024) in view of reassessing the status of implementation and guiding discussions on future needs to reach the agreed objectives.

IMPROVING THE CHARACTERIZATION OF SMALL-SCALE FISHERIES

Recognizing that a common and region-wide definition of SSF does not currently exist in the GFCM area of application, the RPOA-SSF called for an improved characterization of the sector to be adopted as soon as possible, in order to better inform policy interventions. Such a characterization, according to the RPOA-SSF, should reflect the socio-economic relevance and specificities of SSF in this region on the basis of a dynamic set of indicative criteria (such as vessel size, gear used, duration of fishing trips, non-vessel-based fishing activities, etc.) (GFCM, 2018b).

Through the information gathered from the RPOA-SSF monitoring framework questionnaire, 16 out of the 22 responding contracting parties and cooperating non-contracting parties (CPCs) (73 percent) reported to have a legal definition of SSF. Of these countries, six European Union member countries reported that, while a definition was not enshrined within their national legislations, they were nevertheless subject to the legally recognized definition of small-scale coastal fishing of the European Union: "fishing carried out by vessels of an overall length of less than 12 m and not using towed fishing gear". Similar to the definition of the European Union, most national definitions are based on vessel length (most commonly length overall (LOA) less than 12 m, although in select cases, less than 7 m) and gear characteristics (most commonly passive gear). However, other countries also consider horsepower (e.g. < 75 HP), tonnage (e.g. < 3 gross tonnage (GT)) and/or ownership characteristics (e.g. "individual property") as part of the national definition.

Regardless of whether a legal definition exists, most countries (82 percent, i.e. 18 out of 22), reported having at least an informal SSF characterization. Similar to the existing legal definitions, this characterization is primarily based on vessel length and gear used. However, other characteristics were also considered, as outlined in Table 16.

Further work is needed to standardize a regional characterization of SSF in the Mediterranean and Black Sea area, dynamic enough to encompass the different national and subregional specificities, while offering more than a rigid characterization based only on vessel length and gear variables. Building on work initially developed through the FAO Fisheries Division,

TABLE 16. Characterizing small-scale fisheries: main variables used

Variable (number of CPCs which use this variable in their informal characterizations of SSF)	Examples and/or range of values	Most common values
Vessel length (18 CPCs)	< 7 m – < 12 m	< 12 m
Gear used (15 CPCs)	Passive gear; not towed gear; selective gear; specific dimensions and number of gear used	Passive/not towed gear
Distance from the coast to fishing grounds (7 CPCs)	< 6–12 nautical miles from shore; based on the continental shelf	< 6 nautical miles
Horsepower (6 CPCs)	< 50 HP, < 100 HP	< 50 HP
Number of crew (5 CPCs)	2–5 crew	
Length of fishing trip (5 CPCs)	3–15 hrs; < 1 day	< 1 day
Ownership characteristics (4 CPCs)	Individual or owner operated	
Catch disposal (4 CPCs)	Sales to consumers, villages or to agents in fishing ports	Local sales
Gross tonnage (3 CPCs)	1–10 GT	
Mechanisation for gear deployment (2 CPCs)	Both mechanised and manual	
Refrigeration of storage on board (2 CPCs)	Ice and ice boxes	
Value addition (2 CPCs)	High quality fresh products; no value addition	

the GFCM has been testing a "matrix for the characterization of fishing activities" in coordination with the Friends of SSF platform (GFCM, 2019b). Preliminary results have shown the matrix to be a transparent and objective tool for assessing the scale of fisheries and identified vessel length, type of gear used, size of crew, ownership characteristics, length of fishing trip and disposal of catch as key variables for an SSF characterization. Box 18 provides further details on the preliminary testing of the matrix, based on information collected through the GFCM socio-economic survey. Expanded testing of the matrix is underway in the GFCM area of application to refine these results.

ENHANCING THE SCIENCE-POLICY INTERFACE FOR SMALL-SCALE FISHERIES

The RPOA-SSF underlines the need to strengthen scientific knowledge of SSF, while at the same time engaging fishers in monitoring activities in order to capitalize on their local ecological knowledge and facilitate participatory management processes. These themes are stressed throughout the various sections of the RPOA-SSF, but particularly in sections: A. Scientific research; B. Small-scale fisheries data; C. Small-scale fisheries management; and I. Climate and environment.

The RPOA-SSF calls for filling gaps in available knowledge, ensuring appropriate monitoring of SSF activities, including monitoring of catch and effort, as well as of other biological, ecological and socio-economic impacts of SSF. It also calls for reinforcing the body of knowledge on select topics, such as the interactions of SSF with recreational fisheries (Box 19) and with vulnerable species, as well as the potential effects of climate change and non-indigenous species (NIS) on the sector.

On the basis of improved scientific knowledge, the RPOA-SSF foresees strengthening the science-policy interface to facilitate evidence-based and participatory decision-making for the sustainability of the SSF sector. It also advocates for fisheries management favouring low-impact, selective SSF activities in coastal waters. Furthermore, beyond calling for the engagement of fishers in the design, implementation and enforcement of management measures, the RPOA-SSF also calls for their engagement in projects such as the development of climate change adaptation and mitigation plans, finding innovative solutions for the disposal and recycling of marine litter, and developing improved and participatory surveillance in order to monitor fishing activity and reduce illegal, unreported and unregulated (IUU) activity.

Box 18. Preliminary testing of the matrix for the characterization of fishing activities

The matrix for the characterization of fishing activities (GFCM, 2019b) recognizes the difficulty in identifying a simple cut-off between small-scale and large-scale fishing, and that such a distinction is complicated by the fact that a given fishing vessel may show both characteristics typically associated with smaller-scale fisheries and those associated with larger-scale fisheries (e.g. a 16 m vessel that uses traditional artisanal gear).

As agreed by the second meeting of the Working Group on Small-Scale Fisheries (WGSSF), in order to test the matrix in the GFCM area of application, it should be applied to a representative sample of the commercial fishing vessels for each country.

The matrix consists of 12 categories of characteristics (e.g. vessel size, ownership characteristics, length of fishing trip, etc.). For each category, a vessel should be scored between 0–3 (0 being smaller in scale and 3 being larger in scale). Once the vessel has been scored for each category, an aggregate score between 0–36 is produced, placing the vessel on a spectrum ranging from very small-scale (a score of zero) to very large-scale (a score of 36).

In this way, the matrix seeks to provide a transparent and objective tool for assessing scale, providing further insight into the specific characteristics that are most influential and, ultimately, informing discussions towards a dynamic regional characterization of small-scale fisheries. For further information on the matrix for the characterization of fishing activities and its application, see Appendix 4 of the report of the second meeting of the WGSSF (GFCM, 2019b).

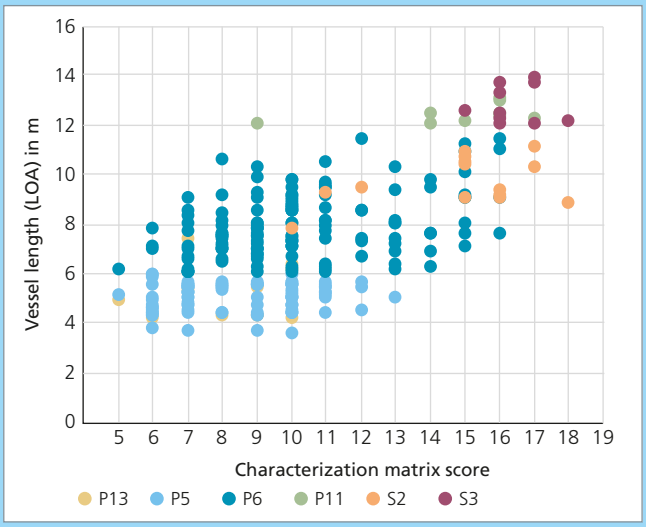
Results of the preliminary testing

The GFCM's socio-economic survey facilitated the collection of relevant data to test the matrix, and the results from the testing in Lebanon were presented to the WGSSF (GFCM, 2019b). Once the aggregate score was calculated for each vessel in the sample, the results were compared. First, the distribution of scores was plotted against vessel length and colour-coded by fleet segment group. This analysis showed that while the fleet segments primarily clustered together, some outliers existed, suggesting that vessel length and gear characteristics alone were not sufficient to assess scale.

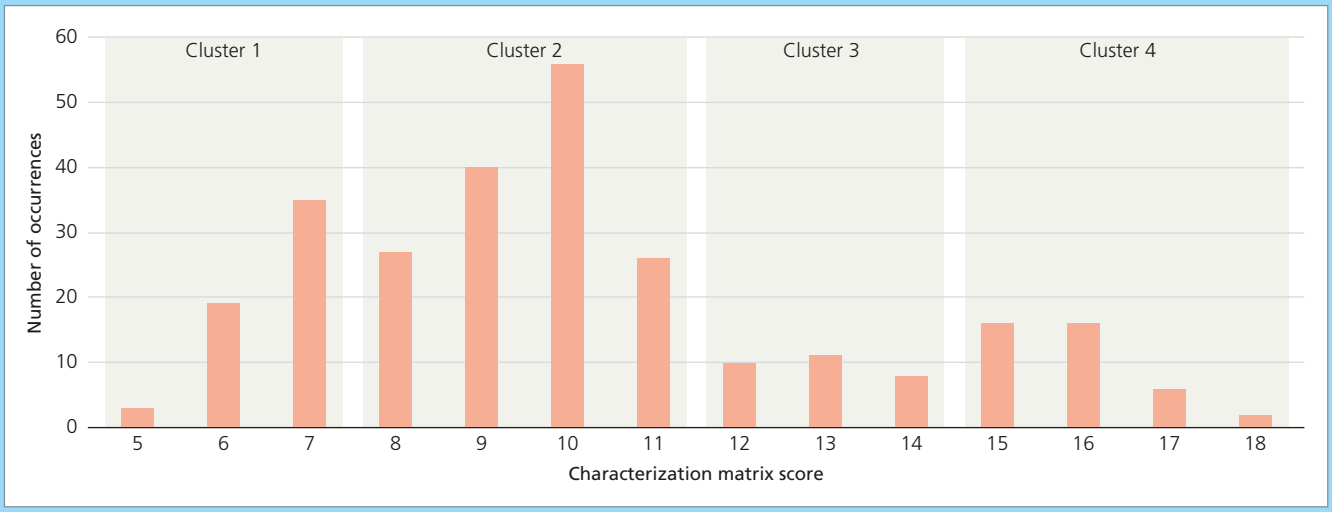
Next, the frequency of each score's occurrence was plotted in order to identify if clusters emerged. In the case of the Lebanese sample, four clusters were identified.

Each cluster was then examined to identify its main characteristics. From this analysis, the results indicated that, while vessel length and the type of gear used were important for determining scale, other variables were also influential, namely, the number of crew members engaged onboard the vessel per day, whether the vessel owner was engaged in the operations of the vessel, the length of the average fishing trip and the role of self-consumption and direct selling.

Distribution of characterization matrix scores by vessel length and fleet segment



Frequency of characterization matrix scores



Baseline status: data collection and monitoring

The second meeting of the WGSSF (GFCM, 2019b) discussed the priorities for research and data collection to support SSF management. The working group underlined that the basic requirements to ensure adequate data collection for SSF consist of a fleet registry containing all SSF vessels and their characteristics and a clear obligation to report landings from SSF, including through adequate monitoring at designated landing points or through self-reporting tools such as logbooks, as well as specific actions to compile social and economic information.

Through the RPOA-SSF monitoring framework questionnaire, the status of these basic requirements was assessed. While 95 percent of responding CPCs (i.e. all but one) indicated they have fleet registers accounting for all SSF vessels, in some cases there is a need to ensure fleet registers are more complete or more regularly updated in order to facilitate accurate data collection. All countries include the vessel name, port of registration and the LOA in their registry, and most also provide a registration number, the year of construction, the vessel's GT, the vessel's horsepower and the main type of gear used. About half of the responding CPCs also included the vessel's authorized port(s) of landing (should it/they differ from the port of registration) and some gave information on the vessel's owner or ownership characteristics. Other information included in the fleet register by select CPCs consisted of fishing license information, operator license information, vessel identifiers (e.g. international radio call signs), vessel monitoring system, place and material of construction, authorized number of days at sea and/or engine power (kW).

While most countries have fairly complete information on the number of SSF vessels in their fleet, more work is needed to ensure adequate monitoring of the catch from these vessels.

Box 19. Interactions between small-scale and recreational fisheries

The Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF) calls for strengthened knowledge on the interactions between small-scale fisheries (SSF) and recreational fisheries (RF) activities in order to identify, monitor and address the main sources of conflict between SSF and RF, as well as to capitalize on the main synergies between these sectors. One of the primary differences between SSF and RF is the nature of their activity: whereas SSF engage in a commercial activity with catch destined for sale, RF is by definition a non-commercial activity – carried out for recreation, tourism or sport – from which the sale of catch is forbidden. As a first step toward assessing the interactions between these sectors, and as a contribution to the GFCM Working Group on Recreational Fisheries (WGRF), Ulman and Ünal (2020) conducted a meta-synthesis of existing studies on interactions between SSF and RF in Mediterranean and Black Sea countries, reviewing existing literature and providing background information on the main issues.

The review highlighted a number of different conflicts, as well as synergies, between the SSF and RF sectors. While the synergies were more limited, the review showed that considering both SSF and RF within an ecosystem approach to fisheries management facilitates conflict resolution and promotes opportunities for transitioning to new revenue-generating employment opportunities (e.g. pescatourism, see definition in Glossary), while also reducing pressure on resources.

On the other hand, the majority of existing literature highlighted conflicts between the SSF and RF sectors. The main types of conflict included conflicts over resources (e.g. targeting the same species), conflicts over space (e.g. unclear or unregulated access or tenure rights to fishing grounds), and competition stemming from regulatory imbalances (e.g. perceived higher regulatory pressure or monitoring requirements on one sector versus the other).

The review suggested a series of practical actions to address negative impacts and promote synergies between SSF and RF, namely:

- supporting the implementation of legal frameworks clearly defining RF as a non-commercial activity and prohibiting the sale of RF catch;
- fighting illegal, unreported and unregulated fishing (a perceived source of conflict between the sectors), improving monitoring, control and surveillance of coastal fishing activities and implementing traceability systems to prevent illegal catch from reaching markets, as well as the sale of RF catch;
- improving knowledge on the impacts of SSF and RF by continuing to enhance data collection for SSF and ensuring that basic RF monitoring is implemented in all countries, in line with the *Handbook for data collection on recreational fisheries in the Mediterranean and the Black Sea* (Grati *et al.*, forthcoming) being developed within the context of the WGRF;
- strengthening scientific advice, conducting stock assessments and addressing gaps in biological data, particularly for species of common importance to coastal fisheries (SSF and RF); and
- addressing conflicts by engaging stakeholders in co-management.

FIGURE 83. Percentage of GFCM contracting parties and cooperating non-contracting parties obligating small-scale vessels to report landings at designated landing ports

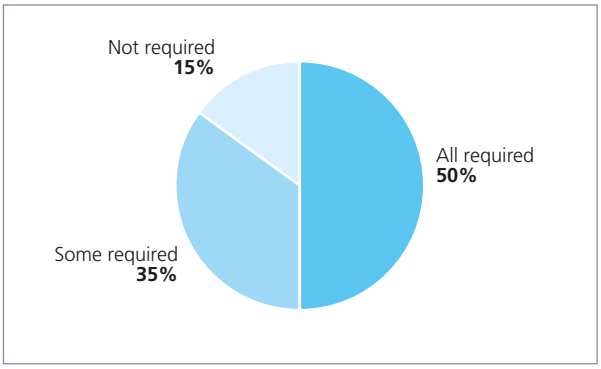
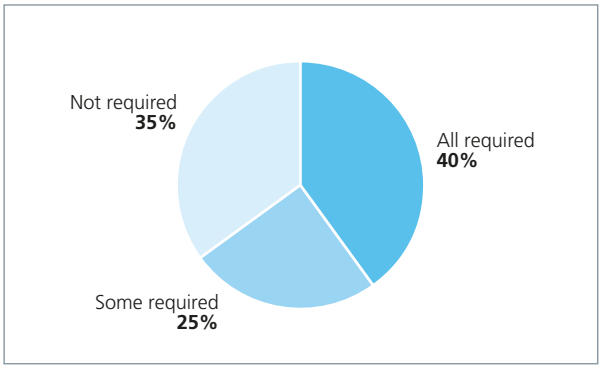


FIGURE 84. Percentage of GFCM contracting parties and cooperating non-contracting parties obligating small-scale vessels to report landings through self-reporting tools

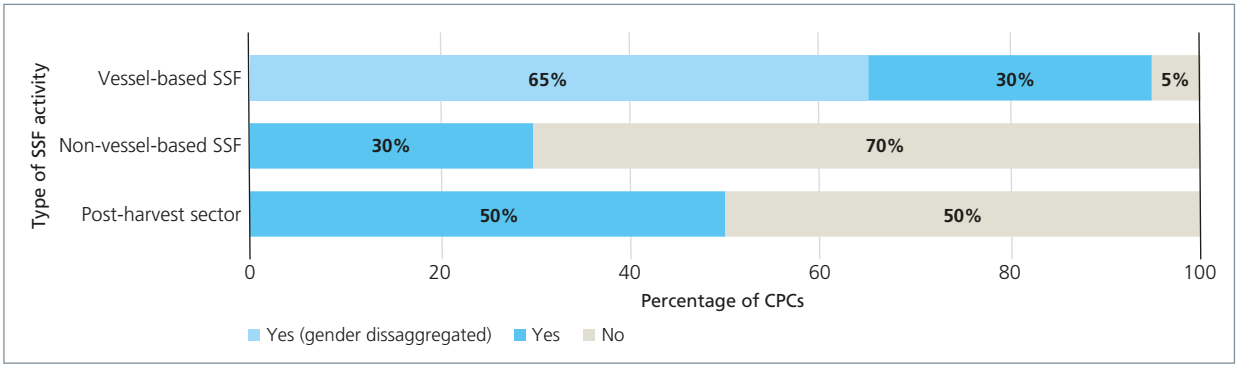


Only half of CPCs require all SSF vessels to report landings at designated landing ports (Figure 83) and only 40 percent require all SSF to use self-reporting tools such as logbooks (Figure 84). These limitations in monitoring ultimately contribute to uncertainties regarding the relative importance of SSF landings by volume (see Figure 18) and by value (see Figure 41) and hinder assessments of the impacts of SSF on certain coastal species. Many countries require some, but not all, SSF to report landings, as is the case in the European Union, where only vessels over 10 m LOA are obligated to report landings.

Most SSF data collection is, however, focused on vessel-based activities, while non-vessel-based fishing – such as the work of shore-based fishers and gleaners – is often unaccounted for. Such data collection is particularly important when assessing the social and economic impacts of the SSF sector, since non-vessel-based SSF activities provide an important source of livelihoods, particularly for women. A similar limitation is shared by the GFCM Data Collection Reference Framework (DCRF) (see Box 1), which only requires the submission of data for employment onboard SSF vessels (and does not require gender-disaggregated data), meaning that all SSF livelihoods are not captured in official statistics. As such, ad hoc studies are needed to collect this information.

As shown in Figure 85, based on the results of the questionnaire carried out, all but one country (i.e. 95 percent) collect data on vessel-based SSF employment, while a majority also collect gender-disaggregated data. However, only 30 percent of countries collect data on employment in non-vessel-based SSF activities, such as gleaning. On the other hand, half of all countries collect information on the post-harvest sector, although no clear definition exists to distinguish small-scale post-harvest work from more industrial post-harvest activities.

FIGURE 85. Percentage of GFCM contracting parties and cooperating non-contracting parties collecting employment data on small-scale fishing activities



In order to address many of these gaps in the data needed for SSF monitoring, the RPOA-SSF encourages data collection systems that are participatory and engage stakeholders. While half of all respondents indicated that models for participatory data collection existed in their country, guidance is needed on what constitutes participatory data collection and how to engage fishers in meaningful ways.

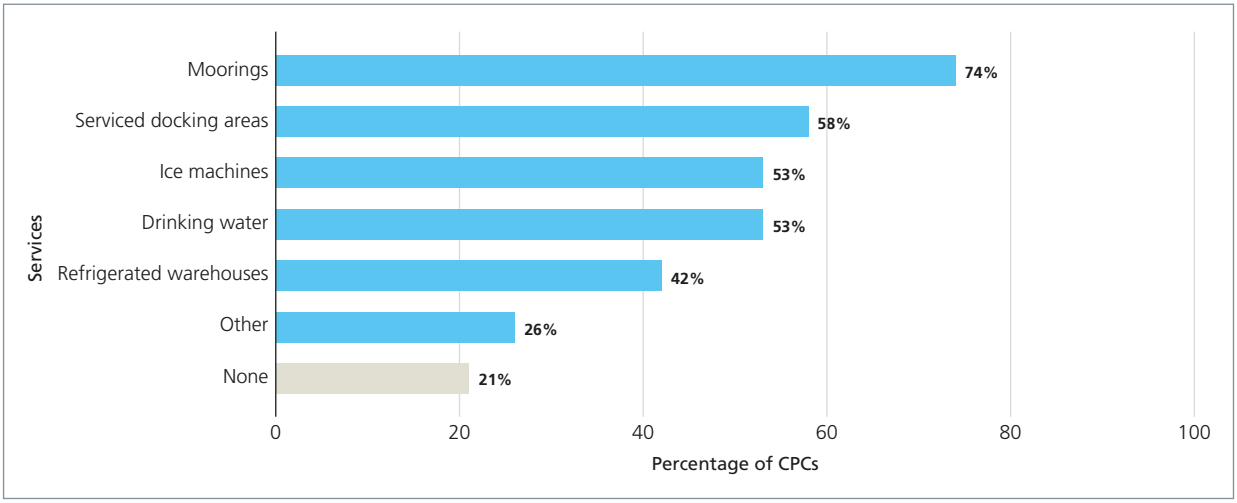
Baseline status: fisheries management

Also discussed during the second meeting of the WGSSF (GFCM 2019b) was the need for a more holistic approach to the management of SSF, one that does not only consider restrictions, but also measures reinforcing sustainable fishing behaviour and promoting the profitability of the sector. While 47 percent of countries reported having fisheries management plans focused on or including SSF, it is important to note that most of these management plans are not specifically directed to SSF, but are rather species-specific. Similarly, 41 percent of countries have specific plans for the adaptation to, and mitigation of, the effects of NIS of relevance to SSF. Therefore, efforts should be made to ensure that SSF are appropriately considered within existing and future species-specific management plans. However, a few countries did report having specific management plans engaging SSF in a more meaningful way, including within the context of marine protected areas and through local co-management arrangements.

With regard to fisheries management, the RPOA-SSF stresses the importance of secure tenure and access rights to fishery resources for SSF. Within this context, the RPOA-SSF underlines the importance of guaranteeing small-scale fishers good and fair access to landing sites adequately equipped for their activities. As far as the services to be provided within these designated landing sites (Figure 86), 74 percent of CPCs require the availability of moorings, while 58 percent require serviced docking areas for SSF vessels. Other common requirements include access to ice machines and drinking water (53 percent of CPCs) and access to refrigerated warehouses (42 percent). Other services required by select countries include safe access, equipment for electronic recording of fishing activities and for measuring catch, fish markets, administrative services, health services, gear storage and scales. However, 21 percent of CPCs do not satisfy any minimum requirements for services to be provided at designated SSF landing sites.

Finally, the RPOA-SSF emphasizes that an essential part of SSF management lies in ensuring proper compliance with management measures and avoiding IUU fishing practices. To this end, the active engagement of small-scale fishers in participatory monitoring, control and surveillance (MCS) is encouraged. Only 33 percent of countries currently report having participatory MCS programmes in place. Therefore, further efforts are needed to disseminate best practices in participatory MCS and to scale up successful examples.

FIGURE 86. Percentage of GFCM contracting parties and cooperating non-contracting parties requiring the provision of select services at designated small-scale fisheries landing sites



Priority actions to enhance the science-policy interface

In order to promote the sustainable management of SSF, the interface between science and policy must be strengthened; central to this reinforcement is the robust engagement of fisher stakeholders. Gaps in data collection and scientific advice should also be addressed. As a short-term priority, efforts are needed to ensure that all CPCs have the capacity to monitor their SSF, including through complete and up-to-date fleet registers, as well as accurate catch, effort and socio-economic data collection in line with DCRF requirements. Important progress in this area has been made in the context of the GFCM mid-term strategy through socio-economic surveys and other ad hoc work, though continued efforts are needed. Furthermore, there is a need to identify and assess key coastal species of particular importance to SSF. To support these efforts, the network of researchers and other stakeholder organizations working in this area is being strengthened to ensure relevant research is carried out and the results widely disseminated. At the same time, prompt action is needed to empower fishers to engage in these processes through, for example, hands-on workshops and the dissemination of practical tools in order to facilitate participatory data collection, co-management and participatory MCS, as shown in Box 21, which provides more information on related ongoing initiatives.

PROMOTING SUSTAINABLE SMALL-SCALE FISHERIES LIVELIHOODS AND SOCIAL DEVELOPMENT

Small-scale fisheries are important in the Mediterranean and the Black Sea not simply because they make up a significant portion of the fleet but also because of their social and economic roles. While other blue economy sectors may provide a larger contribution to national economies, SSF provide crucially important jobs and food security precisely where they are needed most: to vulnerable populations, particularly in rural coastal communities. This essential role of SSF is recognized within the RPOA-SSF, which underlines the need to valorize the SSF sector, maximizing social and economic benefits to SSF and SSF communities. These themes are stressed throughout the various sections of the RPOA-SSF, but particularly in sections: D. Small-scale fisheries value chain; G. Decent work; and H. Role of women.

In particular, the RPOA-SSF calls for strengthening SSF value chains, improving market access for SSF products and increasing the profitability of the sector. Relevant actions promoted by the RPOA-SSF include supporting SSF producer organizations in shortening value chains, facilitating legal frameworks for the direct selling of fresh, local and sustainably fished products, and providing training on catch handling to encourage food safety and to reduce waste. At the same time, the RPOA-SSF reinforces the need to build consumer awareness of the importance of responsible consumption, including by improving product traceability to allow consumers to make informed decisions. The RPOA-SSF recognizes that women play an essential role in SSF value chains and, as such, their efforts should be better accounted for and considered within any development plans.

Coupled with efforts to improve the profitability of the SSF sector, there is also a need to promote the sector's social development, addressing vulnerabilities and removing barriers that may prevent fishers from escaping the poverty cycle. To this end, the RPOA-SSF promotes efforts to ensure decent working conditions, adequate social protection coverage, access to financial services and more, so as to encourage long-term planning, facilitate resilience in the face of crises and reduce negative coping mechanisms. Particular attention should be paid to women working in the sector, in order to ensure their needs are recognized and their work fairly compensated.

Baseline status: value chains, decent work and role of women

To strengthen livelihoods in SSF and better understand gaps in the knowledge needed to work towards the above-mentioned objectives, the RPOA-SSF monitoring framework questionnaire also surveyed countries to understand the status of select topics in relation to value chains, decent work and the role of women.

Limited work has been carried out to date in the region specifically focusing on SSF value chains, with only 26 percent of CPCs indicating in the questionnaire that a value chain analysis had been carried out for the SSF sector at either the national, subnational or local level. However, the European Union has noted that

FIGURE 87. Percentage of GFCM contracting parties and cooperating non-contracting parties providing small-scale fishers with access to health coverage

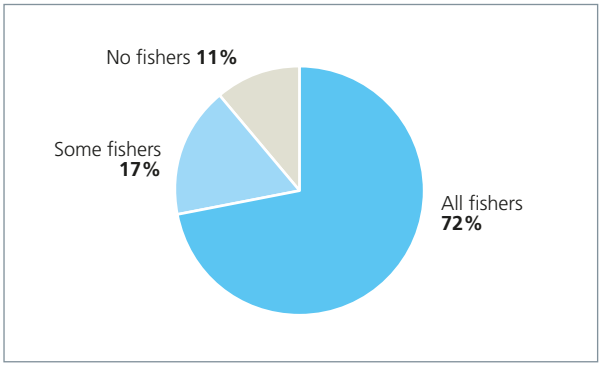


FIGURE 88. Percentage of GFCM contracting parties and cooperating non-contracting parties providing small-scale fishers with access to old age pensions

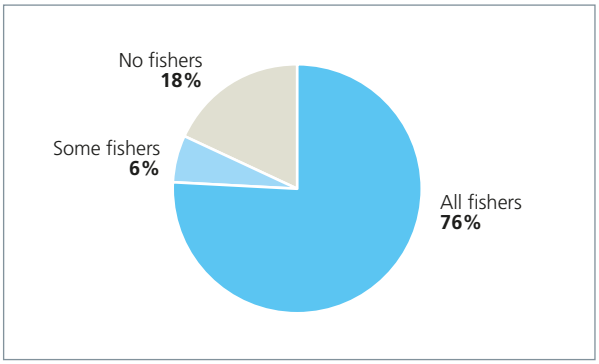
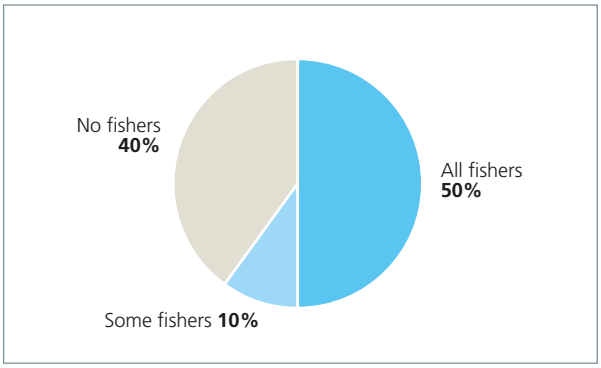


FIGURE 89. Percentage of GFCM contracting parties and cooperating non-contracting parties providing small-scale fishers with access to unemployment insurance



a study on SSF supply chains at the European level is currently under preparation. Similarly, only 20 percent of the countries reported having provided training or assistance to the SSF sector on catch handling and preservation. Six countries (i.e. 35 percent) have, however, indicated that they have plans in place for the valorization or utilization of NIS caught by SSF.

To assess access to social protection for small-scale fishers, the RPOA-SSF monitoring framework questionnaire asked countries to indicate the percentage of small-scale fishers covered under national health services or health insurance programmes, the percentage of small-scale fishers covered by unemployment insurance or other unemployment schemes and the percentage of small-scale fishers with access to old-age pensions. Health insurance coverage was common, with 72 percent (i.e. 13 out of the 18 countries that responded to the question) indicating that all fishers were covered under national or private schemes, an additional 17 percent (i.e. three countries) indicating that a majority (but not all) were covered and only 11 percent (i.e. two countries) indicating that small-scale fishers did not have access to health insurance coverage (Figure 87). Similarly, access to old-age pensions was relatively high in the region (Figure 88), with 76 percent (i.e. 13 out of the 17 countries that responded to the question) indicating that all fishers were covered under pension schemes, 6 percent (i.e. one country) indicating only some had access and 18 percent (i.e. three countries) indicating that small-scale fishers did not have access to old-age pensions. The relatively high coverage of both health insurance and old-age pensions is promising, considering that GFCM studies have shown these two social protection programmes to be the most highly valued by small-scale fishers (Box 20). On the other hand, the questionnaire results indicated low coverage of unemployment insurance (Figure 89), with only 50 percent (i.e. five out of the ten countries that responded to the question) providing access to unemployment insurance for all small-scale fishers, 10 percent (i.e. one country) indicating that some had access (i.e. fish workers only), and 40 percent (i.e. four countries) indicating that small-scale fishers did not have access. However, in the wake of the COVID-19 crisis, countries have responded by activating a number of social protection measures, of which unemployment benefits have been some of the most common. Many of these measures, however, are

temporary ad hoc measures and it remains to be seen whether longer-term social protection programmes will continue.

As previously noted, gender-disaggregated data are not collected in all countries and many do not collect information on non-vessel-based fisheries or on the pre- and post-harvest sectors where many women work. As a result, women are often underrepresented in official statistics, potentially undermining their access to social protection programmes or resulting in their marginalization in decision-making processes. The RPOA-SSF monitoring framework questionnaire therefore attempted to assess the engagement of women in SSF decision-making processes, both within SSF organizations and within fisheries administrations. With regard to SSF organizations, many countries did not have this information available, though, among the eight responding countries, half noted the presence of women within leadership roles (bureau positions) in SSF organizations in their country. On the other hand, the number of countries with senior positions in fisheries administrations filled by women was much higher (77 percent, i.e. ten out of the 13 countries that responded to the question).

Box 20. Reducing small-scale fisher vulnerability through social protection

While small-scale fishers are not necessarily poor (see Chapter 3), they are a highly vulnerable group that can be strongly affected by both covariate (e.g. the COVID-19 crisis) and idiosyncratic (e.g. an injury on the job) shocks disrupting the status quo and upsetting the delicate balance that allows them to provide for themselves and their families. Factors further contributing to the vulnerability of the small-scale fisheries (SSF) sector include: the informal nature of SSF work, which often lacks formal work contracts or official recognition in national labour legislations; variable and unpredictable incomes due to the seasonal nature of SSF and fluctuations in catch and market prices; and the relatively low financial resilience of many small-scale fishers due to limited savings, access to credit and availability of alternative livelihoods.

Social protection allows for reinforcing these areas of vulnerability, improving resilience in the face of shocks and introducing economic opportunities. Defined as the diverse set of policies and programmes addressing economic, environmental and social vulnerabilities to food insecurity and poverty by protecting and promoting livelihoods (FAO, 2017a), social protection can range from cash transfers to health coverage, old-age pensions, unemployment benefits, job training and more.

A study on *Social protection for small-scale fisheries in the Mediterranean region: A review*, carried out by the GFCM in collaboration with the FAO Fisheries Division (FAO, 2019d), found that while most contracting parties and cooperating non-contracting parties have some basic forms of social protection in place, small-scale fishers can face challenges in accessing these programmes. Barriers to extending coverage to SSF can include: the need for fishers to make regular contributions, which may be at odds with the seasonal nature of SSF work; the need for a formal work contract to participate in social protection programmes; concerns about the affordability of extending provision to fishers and fish workers due to fiscal challenges; and a lack of up-to-date information on the size and socio-economic characteristics of the sector, which hinders planning of social protection programmes.

To improve social protection provision for SSF in the Mediterranean region, the GFCM/FAO study recommended investing in regular, up-to-date socio-economic data collection in order to inform accurate and efficient social protection design, thereby ensuring that the most vulnerable segments of the SSF sector are accounted for, particularly gleaners and women. Furthermore, the study recommended promoting incentives allowing social protection and fisheries management to complement each other by, for example, formalizing SSF employment, linking fishing licenses with social fund registration and linking social protection provision to compliance with management measures (e.g. unemployment benefits during temporal closures). Finally, the study recommended that efforts be made to remove obstacles to participation in social protection programmes, for example, by promoting the affordability of social fund contributions, providing flexible payment options to account for seasonality and unpredictability of income, and ensuring that payments can be made at rural locations convenient for small-scale fishers.

Priority actions to promote resilient livelihoods

In order to continue strengthening the role of SSF as an essential component of a sustainable blue economy and, in particular, as a source of resilient and sustainable livelihoods, efforts are needed to unlock economic opportunities for SSF by both enhancing SSF value chains and reinforcing social and economic support to the sector. Priority RPOA-SSF actions that have been identified include: enhancing the body of knowledge on SSF value chains, including by providing guidance and sharing best practices for value chain assessment, as well as improving information about workers along the value chain; advocating for decent work in SSF, including ratification of the International Labour Organization (ILO) Work in Fishing Convention C188 (ILO, 2007); supporting specific interventions to improve coverage of crucial social insurance programmes (e.g. health insurance, pensions and unemployment insurance) for SSF, particularly in light of the risks presented by the ongoing COVID-19 crisis and looming climate change impacts; and assessing the role of women in Mediterranean and Black Sea SSF, including providing guidance on improving gender-disaggregated data collection along the value chain.

EMPOWERING SMALL-SCALE FISHERY STAKEHOLDERS

A transversal thread throughout the different thematic topics of the RPOA-SSF is the importance of engaging stakeholders, specifically small-scale fishers and fisher representatives, through participatory processes and ensuring that stakeholders have a voice in decision-making. To this end, considerable capacity-building initiatives are prescribed within the RPOA-SSF. These themes are stressed throughout the various sections of the RPOA-SSF, but particularly in sections: E. Participation of small-scale fisheries in decision-making processes; and F. Capacity building.

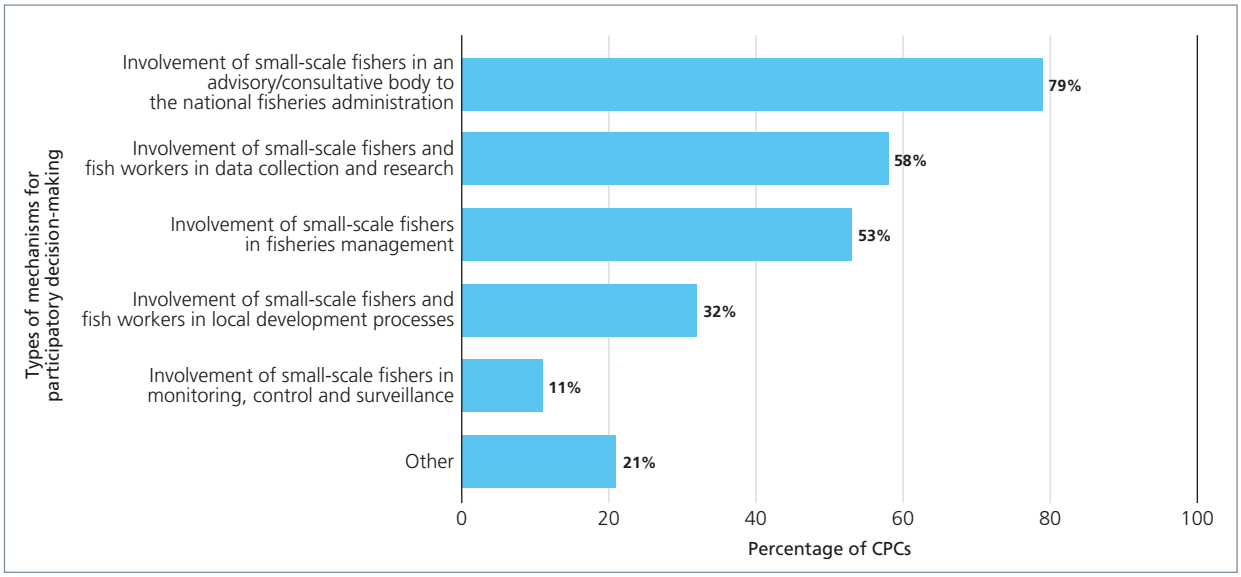
In particular, the RPOA-SSF calls for fishers to engage in fisheries management, including through participatory data collection and within co-management bodies. The RPOA-SSF also calls on national administrations to reinforce the legislative and institutional mechanisms necessary to recognize SSF organizations and facilitate their inclusion in decision-making processes. Finally, the RPOA-SSF calls for a stronger network of SSF organizations at the regional level in order to promote cooperation and synergies, share knowledge and disseminate best practices. In particular, specific capacity-building initiatives are foreseen to empower stakeholders through learning exchanges and other training opportunities on relevant topics.

Baseline status: stakeholder engagement and capacity building

In order to better understand the status of SSF stakeholder engagement in decision-making processes, the RPOA-SSF monitoring framework questionnaire surveyed countries to determine how they engage with SSF organizations. Almost all countries (85 percent, i.e. 17 out of the 20 that responded to the question) reported having mechanisms for participatory decision-making in place for SSF. In most countries, these mechanisms consisted of advisory or consultative bodies providing input to national or provincial fisheries administrations, in which small-scale fishers and/or fish workers participated. However, small-scale fishers also engaged in decision-making processes by contributing to data collection and research, and to fisheries management at the fishery level. In a few countries, fishers were also involved in local development councils, in participatory MCS schemes, or in other ways, such as through public consultations and technical working groups (Figure 90). More information would be needed, however, to better understand the extent to which such participatory processes are effective and representative of all SSF stakeholders.

The RPOA-SSF monitoring framework questionnaire also assessed the types of training and capacity-building programmes offered to SSF in Mediterranean and Black Sea countries (Figure 91). Eleven out of 18 countries (i.e. 61 percent of respondents) reported providing training programmes, with the most common topics concerning safety at sea through the use of communication and navigation equipment, as well as professional training for young people entering the sector.

FIGURE 90. Percentage of GFCM contracting parties and cooperating non-contracting parties with mechanisms in place to engage small-scale fisheries stakeholders in decision-making



Box 21. The SSF University

The SSF University is a capacity-building initiative for small-scale fishers and fish workers, designed to share knowledge on select topics of relevance to the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF) and to promote the exchange of best practices throughout the Mediterranean and Black Sea region.

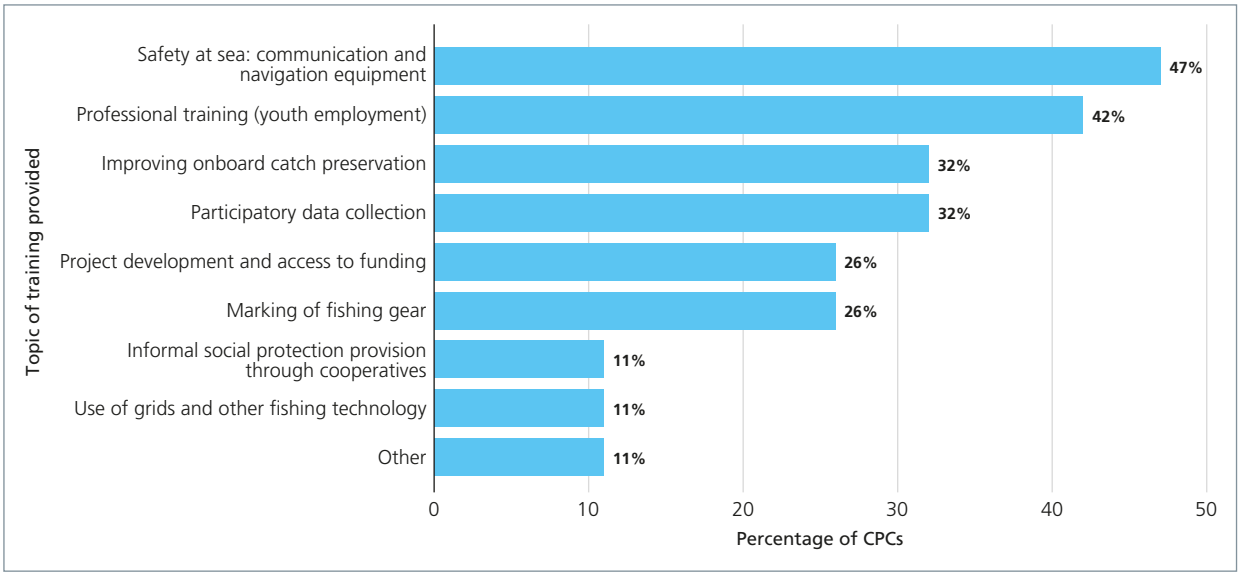
This initiative, launched in early 2020 in collaboration with the Friends of SSF platform, responds to the recommendations within the RPOA-SSF toward ensuring that small-scale fishers and fish workers gain the necessary capacity and skills to contribute towards sustainable small-scale fisheries and livelihoods. In particular, paragraph 39e of the RPOA-SSF calls upon countries to:

> *"Facilitate education and training opportunities for men and women of the fisheries sector, such as summer universities, aimed at developing fisheries-specific skills, policy knowledge (fisheries, environment) and, in particular, knowledge and innovative solutions and technology developments".*

This initiative also supports the implementation of the *Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication* (SSF Guidelines; FAO, 2015b), which strongly recommend enhancing the capacity of small-scale fishing communities in order to enable them to participate in decision-making and development processes.

The SSF University consists of a series of workshops for small-scale fisheries stakeholders, focusing on the fishers and fish workers active in the sector. The structure of each workshop varies and may consist of classroom learning, in-the-field experience and/or peer-to-peer exchanges. Fishers from throughout the region are encouraged to participate in the SSF University and efforts are made, to the extent possible and as relevant, to facilitate wider participation through travel support and language interpretation. More information is available at: http://www.fao.org/gfcm/activities/fisheries/small-scale-fisheries/ssfuniversity/en/

FIGURE 91. Percentage of GFCM contracting parties and cooperating non-contracting parties offering training programmes for small-scale fishers



Priority actions to empower stakeholders

In order to further strengthen the engagement of a wide range of SSF stakeholders at the regional level, efforts are needed to identify and reinforce links with the main actors in the region. This process is foreseen to be achieved by providing increased opportunities for SSF organizations to participate in GFCM events, including, but not limited to, the SSF University (Box 21). In this context, consultations with key stakeholder organizations are envisaged in order to assess needs and identify key entry points for engagement (e.g. co-management committees, fisher exchanges, pilot studies, training workshops, etc.). In particular, efforts are needed to ensure that such programmes reach a wider number of stakeholders, including young fishers and women.

7. Fisheries management

This chapter provides a summary of the fisheries management measures adopted since the last issue of *The State of Mediterranean and Black Sea Fisheries* (i.e. over the period 2018–2019) at the regional and subregional levels in the Mediterranean and the Black Sea. Its main focus is on the most relevant fisheries multiannual management plans and new measures adopted, including the determination of total allowable catch (TAC) and quotas, as well as on spatial management measures, including actions taken towards identifying and protecting vulnerable marine ecosystems (VME) in the Mediterranean Sea. In the case of deep-sea fisheries (e.g. deep-water red shrimp fisheries in the Mediterranean Sea), the two issues are strongly interconnected, requiring technical work towards both the mapping of fishing grounds/fishing footprint and the adequate collection of information on bycatch.

In addition, this chapter describes a series of newly launched GFCM research programmes, which encourage relevant countries to collect scientific data toward the identification and implementation of new fisheries management measures (e.g. catch certification schemes), as well as the development of existing transitional measures into long-term ones. The information used in this chapter originates primarily from the outcomes of relevant GFCM expert meetings held in 2018–2019 and the from *Compendium of GFCM decisions* (GFCM, 2019a), which is summarized in terms of fisheries and conservation management measures in Table 17.

TABLE 17. Summary of the main management and conservation measures contained in GFCM decisions and technical documents

	GSA	MAIN MANAGEMENT AND CONSERVATION MEASURES																					GFCM FRAMEWORK FOR SCIENTIFIC RESEARCH
		Authorized fishing gear	Authorized landing ports	Bycatch reporting obligation	Catch limit/TAC	Catch record	Discard landing obligation	EFH protection through an FRA	Finning prohibition	Fishing authorizations register	Fishing effort record	Fishing effort restrictions (fishing days and/or fleet capacity)	Fishing gear characteristics	Good practice and species identification giudes	Harvest control rule / F target	International inspection plan	Logbook / VMS	Minimum conservation landing size	Precautionary closures	Protection framework	Spatial/temporal restrictions to fisheries (other than FRAs)	Transshipment prohibition	
FISHERIES																							
Blackspot seabream	1–3		43/2019/2	43/2019/2		41/2017/2 43/2019/2				41/2017/2 43/2019/2	41/2017/2 43/2019/2	41/2017/2 43/2019/2	43/2019/2				43/2019/2	41/2017/2 43/2019/2				41/2017/2 43/2019/2	
Blue crab	Mediterranean Sea																						42/2018/7
Common dolphinfish	Mediterranean Sea					43/2019/1				43/2019/1			43/2019/1				35/2011/1 *43/2019/3 33/2009/7				30/2006/2		43/2019/1
Deep-water red shrimp	19–21		42/2018/4	42/2018/4		42/2018/4				42/2018/4	42/2018/4	42/2018/4				42/2018/4	42/2018/4					42/2018/4	
	24–27		42/2018/3	42/2018/3		42/2018/3				42/2018/3	42/2018/3	42/2018/3				42/2018/3	42/2018/3					42/2018/3	
	12–16		43/2019/6							43/2019/6		43/2019/6					43/2019/6					43/2019/6	
Demersal species	9							33/2009/1				33/2009/1											
	12–16		42/2018/5			42/2018/5		42/2018/5		42/2018/5	42/2018/5	42/2018/5			42/2018/5	42/2018/5 42/2018/6	42/2018/5	42/2018/5			42/2018/5	42/2018/5	
	17–18			43/2019/5		43/2019/5		43/2019/5		43/2019/5	43/2019/5	43/2019/5				43/2019/5	43/2019/5	43/2019/5			43/2019/5	43/2019/5	
European anchovy and sardine	17–18				40/2016/3	37/2013/1		42/2018/8		37/2013/1 40/2016/3 42/2018/8	37/2013/1	40/2016/3 42/2018/8			37/2013/1	42/2018/1	37/2013/1	37/2013/1			38/2014/1 39/2015/1 40/2016/3 42/2018/8		
European eel	Mediterranean Sea	42/2018/1	42/2018/1		42/2018/1	42/2018/1				42/2018/1	42/2018/1								42/2018/1		42/2018/1		42/2018/1
Piked dogfish	Black Sea					39/2015/4 36/2012/3 42/2018/2	39/2015/4				39/2015/4							39/2015/4			36/2012/3 42/2018/2		
Rapa whelk	Black Sea																						42/2018/9
Red coral	Mediterranean Sea	43/2019/4	43/2019/4		43/2019/4	43/2019/4				43/2019/4	43/2019/4							43/2019/4	43/2019/4		43/2019/4	43/2019/4	43/2019/4
Turbot	Black Sea	37/2013/2	39/2015/3	43/2019/3 41/2017/4	43/2019/3 41/2017/4	43/2019/3 41/2017/4				43/2019/3 41/2017/4	43/2019/3 41/2017/4	43/2019/3 41/2017/4	39/2015/3			43/2019/3 41/2017/4	43/2019/3 41/2017/4	43/2019/3 41/2017/4			43/2019/3 41/2017/4	43/2019/3 41/2017/4	
VULNERABLE SPECIES AND HABITATS																							
Cetaceans	Mediterranean and Black Sea			36/2012/2										Available						36/2012/2			
Monk seal				35/2011/5																35/2011/5		35/2011/5	
Seabirds				35/2011/3										Available						35/2011/3			
Sea turtles				35/2011/4										Available						35/2011/4		35/2011/4	
Conservation-priority sharks and rays				36/2012/3 42/2018/2		36/2012/3 42/2018/2			36/2012/3 42/2018/2					Available						36/2012/3 42/2018/3	36/2012/3 42/2018/2	36/2012/3 42/2018/2	
Vulnerable marine ecosystems (VMEs)	Mediterranean and Black Sea			*43/2019/6										Available							29/2005/1		
	19																				30/2006/3		
	25																				30/2006/3		
	26																				30/2006/3		

Note: * indicates GFCM resolutions.

MANAGEMENT MEASURES

Since the adoption of the first comprehensive GFCM multiannual management plan for small pelagic fisheries in the Adriatic Sea in 2013[11], the GFCM has made significant strides forward, having adopted ten adaptive multiannual management plans as of 2020. While some are more structured, outlining specific long-term measures (e.g. for the protection of Black Sea turbot), others are only incipient management plans involving preliminary transitional measures pending the collection of new scientific data to inform future longer-term measures (Table 17). Accordingly, multiannual management plans all specify adaptive mechanisms to be implemented in order to achieve specific objectives within desired timeframes and maintain results over time, while accounting for changing and evolving stocks, fisheries and environments (Table 17). Along these lines, the past two years have witnessed the adoption of five new management plans and the revision of four existing ones, as well as the introduction of four recommendations outlining new management measures or updating existing ones. This section summarizes the main advances in terms of regional and subregional management plans in the Mediterranean and the Black Sea.

Common dolphinfish fisheries and the use of anchored fish aggregating devices in the Mediterranean Sea

The common dolphinfish (*Coryphaena hippurus*) is a GFCM priority species of regional importance, whose management, owing to its ubiquity, must be addressed at the level of the entire Mediterranean basin. The species is mainly fished by employing anchored fish aggregating devices (FADs), whose impacts on the environment have been the focus of increasing attention. The first decision covering this fishery dates back to 2006, when a closed season to protect juveniles was established at the Mediterranean level[12]. In 2019, in line with the precautionary principle, this recommendation was complemented by a new one, Recommendation GFCM/43/2019/1[13], which established transitional management measures applicable to the fishing vessels of GFCM contracting parties and cooperating non-contracting parties (CPCs) exploiting common dolphinfish in the GFCM area of application. These transitional measures are to be maintained until permanent measures are identified and adopted. The aim of the recommendation is to prevent the biomass level of the common dolphinfish stock from dropping below biologically sustainable levels. The main operational objectives of this recommendation are to increase knowledge, manage the deployment, recovery and potential loss of FADs, and to reduce and limit their impacts on the ecosystem (Table 17). The measures included therefore work to address the different components of fishing mortality (e.g by limiting the number of FADs deployed), to maintain fishing effort (i.e. the number of fishing vessels) at the current level, to minimize the entanglement of non-target vulnerable species and other impacts on the environment, and to set the basis for regulating the composition, location, maintenance and replacement of FADs, as well as for their identification and marking (Table 17). The decision also lays the foundations for the establishment of new FAD fisheries and imposes the use of a fishing authorization system with an associated register maintained by each CPC. Finally, with a view to increasing knowledge of the fishery and its target species, the recommendation underlines the need to facilitate the collation of existing relevant data and the collection of new data (including research survey data) via a research programme ultimately aimed at informing the development of future conservation measures.

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

Transitional measures for the management of blackspot seabream (*Pagellus bogaraveo*) in the Alboran Sea were set out in 2017[14]. Taking into consideration work previously done by

[11] 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 on small pelagic stocks in geographical subarea 18 (southern Adriatic Sea).

[12] Recommendation GFCM/30/2006/2 on the establishment of a closed season for the common dolphinfish fisheries using fish aggregating devices.

[13] Recommendation GFCM/43/2019/1 on a set of management measures for the use of anchored fish aggregating devices in common dolphinfish fisheries in the Mediterranean Sea.

[14] Recommendation GFCM/41/2017/2 on the management of blackspot seabream fisheries in the Alboran Sea (geographical subareas 1 to 3) for a two-year transition period.

both the Working Group on Stock Assessment of Demersal Species, who had performed a benchmark assessment, and by the Subregional Committee for the Western Mediterranean, who had laid down the technical elements in support of the management of this fishery, a new recommendation was adopted in 2019[15], establishing an adaptive multiannual management plan for blackspot seabream commercial fisheries using longlines and handlines, with the aim of maintaining fishing mortality at levels consistent with the maximum sustainable yield (MSY). Importantly, this decision establishes transitional measures limiting catch and effort, as well as technical (encouraging active trials or the adoption of alternative gear and/or mitigation measures), conservation (minimum conservation reference size of 30 cm total length) and fleet management (fishing authorizations and vessel monitoring system (VMS)) measures to control and enforce dispositions (designated ports, catch recording, transshipment bans) (Table 17). The expectation is that a long-term management plan will be adopted by the GFCM in 2022.

Black Sea turbot fisheries (geographical subarea 29)

Since the recommendation in 2013[16] establishing minimum measures for bottom-set gillnet fisheries targeting turbot (*Scophthalmus maximus*) in the Black Sea, three more recommendations have been adopted to regulate the Black Sea turbot fishery.

A multiannual management plan outlining transitional measures was adopted in 2017[17], containing, among other measures, a TAC and quotas for each Black Sea country. Based on the scientific advice on stock status provided by the recent benchmark assessment of Black Sea turbot (see Chapter 5) and on a number of additional criteria (Box 22), this TAC was revised and amended by Recommendation GFCM/43/2019/3[18]. A comparison between the annual TAC and quotas set for the 2018–2019 period and the new provisions determined for the 2020–2022 period is provided below.

CPC	Annual quotas (tonnes)		Percentage	
	2018–2019	2020–2022	2018–2019	2020–2022
European Union	114	150	18	18
Turkey	374	497	58	58
Ukraine	101	160	16	19
Georgia	5	20	1	2
Others	50	30	7	3
TAC	**644**	**857**	**100**	**100**

Importantly, the recommendation also outlines the provisions to be taken when the catch reaches 90 percent of the quota and when the quota is exhausted, including closure of the fishery and a payback scheme.

For the first time in the GFCM area of application, this recommendation also advocates for the implementation of a traceability mechanism for turbot catch (Box 23).

Demersal fisheries in the Adriatic Sea (geographical subareas 17–18)

In order to address issues related to an intense multispecies demersal fishery, a multiannual management plan[19] towards the sustainable fishing of European hake (*Merluccius merluccius*), Norway lobster (*Nephrops norvegicus*), common sole *(Solea solea),* deep-water rose shrimp *(Parapenaeus longirostris*) and red mullet (*Mullus barbatus*), by means of otter trawls, beam trawls, bottom pair trawls and otter twin trawls in the Adriatic Sea (geographical subareas (GSAs) 17–18), was adopted in 2019. This plan was the product of extensive work carried out by relevant countries and the Subregional Committee for the Adriatic Sea that resulted in the implementation of a fisheries restricted area (FRA) in the Jabuka/Pomo Pit as well.

With the overall goal of reaching MSY by 2026, this multiannual management plan is based on a two-step approach applicable to fleets fishing more than a certain number of days per year. It foresees an initial transitional fishing effort regime in 2020–2021 aimed at decreasing effort by set percentages (12 percent for otter

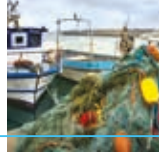
[15] Recommendation GFCM/43/2019/2 on a management plan for the sustainable exploitation of blackspot seabream in the Alboran Sea (geographical subareas 1 to 3).

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

[17] Recommendation GFCM/41/2017/4 on a multiannual management plan for turbot fisheries in the Black Sea (geographical subarea 29).

[18] Recommendation GFCM/43/2019/3 amending Recommendation GFCM/41/2017/4 on a multiannual management plan for turbot fisheries in the Black Sea (geographical subarea 29).

[19] Recommendation GFCM/43/2019/5 on a multiannual management plan for sustainable demersal fisheries in the Adriatic Sea (geographical subareas 17 and 18)



Box 22. Total allowable catch and quotas as fisheries management tools

Total allowable catch (TAC), also referred to as fishing opportunities, consists of quantitative limitations on the amount of catch that can be taken from a given stock and is usually expressed in units of weight (tonnes). It falls into the category of output control management measures – as opposed to input measures, which include measures such as fishing effort control and gear regulations.

Total allowable catch is an effective instrument used to regulate catch in such a manner as to attain maximum sustainable yield (MSY). In the case of data-limited situations, the precautionary approach should be followed.

Total allowable catch is generally based on scientific information determined by a technical body, complemented by a set of general rules. Such general rules may include an agreement on decreasing TAC should the stock in question be overfished or on increasing it should the stock be underfished.

The methods used for determining TAC depend on the amount of information available for the fishery in question and, in general terms, include:

- Risk-based approaches: the TAC for a stock is set based on the outcomes of a quantitative stock assessment and a subsequent risk assessment, carried out with respect to the resource itself, i.e. spawning stock biomass (SSB), and the catch under different scenarios of fishing mortality (F), or vice versa, based on reference points for both SSB and F in relation to MSY; these are also known as catch scenarios. Risk assessments may be more or less complex depending on the quantity and quality of information available and can also include socio-economic considerations. The two main tools for this approach are: i) short- and medium-term forecasts; and ii) management strategy evaluation.
- Precautionary approaches based on trends (e.g. of historical catch): using the time series of catch, a percentage is applied to determine the TAC. This method is usually based on the assumption that historical catch was sustainable.

The TAC is usually split into quotas among actors within a fishery. In the case of fisheries involving more than one country, the TAC is subdivided into quotas for each country, which can, if needed, be further subdivided by gear type (or by any other category required). Quotas may or may not be transferable, inheritable, or tradable. While generally used to allocate TAC, quotas could also be used to allocate fishing effort.

Quotas are determined following a series of criteria agreed among and within countries. Such criteria include all sorts of considerations, from the biological/scientific standpoint to the perspectives of governance and politics. An analysis of the issue as experienced by different regional fisheries management organizations around the world revealed that agreeing on quota allocation and the criteria used to determine them, as well as controlling their impacts on the fishery, present a complex and difficult exercise but also a vital one. As such, different organizations around the world have agreed upon different criteria.

Only two fisheries in the GFCM area of application are managed using annual catch limits or TAC: small pelagics in the Adriatic Sea and turbot in the Black Sea. Scientific advice on stock status provided by the GFCM in both areas is based on stock assessments carried out for the whole area/subregion in question. As assessments of Black Sea turbot, for example, include information on relevant fisheries (catch, effort, abundance at sea) provided by all coastal countries, stock status can be determined over the entire Black Sea. It follows that TAC based on this advice will cover the whole Black Sea and be subsequently split into country quotas.

The most recent TAC for turbot was based on the results of a benchmark assessment and short-term forecasts of the effect of different levels of F and catch. Following the scientific determination of the TAC, the Working Group on the Black Sea discussed the criteria to be adopted for the allocation of quotas to contracting parties and cooperating non-contracting parties (CPCs) and agreed on the following eight criteria:

- historical catch and historical fishing patterns of qualifying members;
- status of the stock and scientific advice;
- control mechanisms and the fight against illegal, unreported, and unregulated fishing;
- compliance of qualifying members to the GFCM conservation and management measures for turbot;
- status of the qualifying parties, whether contracting party or cooperating non-contracting party;
- socio-economic aspects of the fishery;
- contribution of the fishery to the national food security of qualifying members; and
- contribution of the qualifying member to GFCM scientific activities.

Following the agreement and based on a test trial proposed by the European Union for all CPCs, a management scenario of a TAC, including the allocation of quotas, was presented to, and subsequently adopted by the forty-third session of the GFCM as Recommendation GFCM/43/2019/3 amending Recommendation GFCM/41/2017/4 on a multiannual management plan for turbot fisheries in the Black Sea (geographical subarea 29).

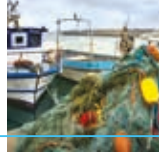
Box 23. Catch certification schemes in fisheries

In recent years, there has been a substantial growth in voluntary certification schemes for agricultural products and foodstuffs. Such schemes provide assurance, through a certification mechanism, that certain characteristics or attributes of the product or its production method/system have been respected. They cover a wide range of different initiatives functioning at different levels of the food supply chain. While certification schemes by definition rely on third-party attestation, other schemes in the market operate on the basis of a label or logo (often registered as a trademark), without involving any certification mechanism (European Commission, 2010).

Certification schemes are also becoming significant features of international fish trade and marketing. They have emerged as a method to improve public awareness of the importance of concepts such as sustainability and responsible fisheries management, as well as to fight illegal, unreported and unregulated (IUU) fishing. In addition, in some cases, they are promoted by national or international authorities for particular fisheries, usually for products with high economic value and/or those with a history of IUU fishing or other kinds of fraud. Certification is also becoming more common in efforts to ensure food safety and quality and environmental sustainability in the growing aquaculture industry. The schemes facilitate traceability, transparency in production processes and the standardization of products from a range of international suppliers. Adhering to an environmental standard or ecolabel provides retailers and brand owners with insurance against negative media coverage and boycotts from environmental groups. Moreover, it helps them tap into and promote consumer demand for ethical products. Indeed, the fisheries procurement policies of most large retailers typically foresee a significant sustainability component, often including the requirement that wild-caught fish be certified by an ecolabel and that farmed fish and seafood be certified by an aquaculture certification scheme. Suppliers working at the post-harvest level are increasingly required to be certified by a private food safety management scheme. The onus is increasingly on suppliers to verify that their products meet certain standards. Certification provides this "burden of proof" (Washington and Ababouch, 2011).

In particular, catch documentation schemes (CDS) are effective market-related monitoring, control and surveillance tools employed worldwide to combat IUU fishing, allowing the product to be traced from the point of capture all the way through the supply chain (FAO, 2015a). These can be unilateral (involving one single country or a union of countries, e.g. the European Union CDS covering all marine wild-caught fish traded by non-European Union countries into the European market) or multilateral (involving many countries, e.g. those established and used by regional fisheries management organizations for specific resources). A notable example is provided by the CDS established by the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) to combat IUU fishing by unlicensed vessels, who were responsible for over 80 percent of toothfish (*Dissostichus* spp.) catch in the 1990s. The aim of this CDS is to trace the origins of the toothfish entering the market and to determine whether they are harvested within the CCAMLR convention area and caught in a manner consistent with CCAMLR conservation measures. In order to effectively achieve this, the CDS covers all toothfish marketed worldwide, which has resulted in close to 0 percent IUU-caught fish in recent years.

The GFCM has now began discussing the development of fishery certifications to ensure that selected resources are fished according to standards of sustainability as set by relevant GFCM decisions. Catch certification or documentation schemes are currently under discussion within the GFCM to guarantee the traceability of two priority species – red coral (*Corallium rubrum*) in the Mediterranean and turbot (*Scophthalmus maximus*) in the Black Sea. Mechanisms to trace red coral from the landing site to the jewel retailer, together with the certification of legal harvesting practices of red coral in line with GFCM decisions, are considered some of the most efficient ways to prevent Mediterranean red coral originating from IUU fishing from entering the market. Regarding Black Sea turbot, in response to Recommendation GFCM/43/2019/3 amending Recommendation GFCM/41/2017/4 on a multiannual management plan for turbot fisheries in the Black Sea (geographical subarea 29), the GFCM is developing a CDS that will be issued by the competent authorities of the involved contracting parties and cooperating non-contracting parties with the primary aim of "determining throughout the supply chain whether fish originate from catches taken consistent with applicable national, regional and international conservation and management measures" (FAO, 2017b).



trawls and 16 percent for beam trawls compared to the annual effort of 2015 or the average of 2015–2018), followed by yearly fishing effort quotas in 2022–2026. This process is coupled with corresponding fleet management measures aimed at restricting and controlling fleet capacity with respect to the same reference period (Table 17).

Recommendation GFCM/43/2019/5 also sets minimum conservation reference sizes for the key species: 20 mm carapace length (CL) for deep-water rose shrimp; 20 mm CL or 70 mm total length (TL) for Norway lobster; 20 cm TL for common sole and 11 cm TL for red mullet. Specimens measuring less than these sizes will neither be retained onboard, transshipped, transferred, landed, stored, sold, displayed nor offered for sale. The management plan further foresees that the status of these key stocks should be assessed yearly, along with the biological, economic and social implications of implementing alternative management scenarios. In the absence of such advice, the precautionary approach shall be adopted and management measures determined accordingly.

Additionally, the recommendation encourages the establishment of FRAs for demersal fishing, particularly in the northern and southern Adriatic, and offers several options for spatiotemporal restrictions of coastal/territorial waters.

Finally, the implementation of specific measures addressing illegal, unreported and unregulated (IUU) fishing activities (e.g. designated landing and transshipping times and locations, electronic catch declarations, authorized vessels, use of VMS) is prescribed, as well as the establishment of an observation and inspection programme to ensure compliance with the conservation and management measures contained in the recommendation.

Management measures for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp in the Strait of Sicily (geographical subareas 12–16)

Following two recommendations establishing multiannual management plans for sustainable trawl fisheries targeting two deep-water red shrimp species in the Levant Sea (GSAs 26–27) and the Ionian Sea (GSAs 20–21)[10], a recommendation establishing management measures for sustainable trawl fishing activities targeting giant red shrimp (*Aristaeomorpha foliacea*) and blue and red shrimp (*Aristeus antennatus*) in the Strait of Sicily was adopted in 2019[21]. In preparation for a future management plan, this decision establishes the need to ensure adequate scientific monitoring of the status of the two species and to assess the biological, economic and social implications of implementing alternative management scenarios. Recommendation GFCM/42/2019/6 also lays down fleet management measures (e.g. authorized vessels, catch reporting irrespective of the volume of the catch and the designation of additional spatiotemporal restrictions), as well as measures aimed at managing fishing effort (e.g. communicating historical levels of fishing effort and maintaining fleet capacity) and at addressing IUU fishing activities by having designated landing points, prohibiting transshipment, etc. (Table 17).

Vulnerable marine ecosystems formed by cnidarian (coral) communities in the Mediterranean Sea

The GFCM, at its forty-third session (FAO, 2020b), adopted Resolution GFCM/43/2019/6 on the establishment of a set of measures to protect vulnerable marine ecosystems formed by cnidarian (coral) communities in the Mediterranean Sea. This resolution establishes a direct link between fisheries and the conservation of biodiversity by encouraging CPCs to implement transitional measures aimed at preventing significant adverse impacts (SAI) on deep-sea VME. These measures involve regulating the activities of large vessels (> 15 m length overall) operating bottom contact gear (e.g. bottom trawls) deeper than 300 m or on seamounts, particularly of those targeting deep-water shrimp species, with the aim of preventing or reducing their impact on the coral communities protected under Annex II of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean

[20] 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).

[21] Recommendation GFCM/43/2019/6 on management measures for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp in the Strait of Sicily (geographical subareas 12, 13, 14, 15 and 16).

PLATE 1. The corals *Antipathella subpinnata*, *Callogorgia verticillata* and *Savalia savaglia*

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(SPA/BD Protocol) of the Barcelona Convention (1992) (Box 24). Three examples of near threatened coral species, according to the International Union for Conservation of Nature (IUCN) Red List Category for Mediterranean corals (IUCN, 2020), are shown in Plate 1.

Such measures should be in line with the protocols for the protection of VME endorsed by the forty-second session of the GFCM (FAO, 2019c), which include the observation of encounter rules, whereby deep-sea fishing vessels should report the details (position, taxon and weight) of any encounters with VME indicator taxa (see page 126), and the application of an exploratory deep-sea bottom fishing protocol by deep-sea fisheries vessels operating in previously unfished areas.

In order to follow the encounter rules foreseen by the protocol, for example, the resolution considers that any VME indicator taxa comprising bycatch should be reported and that an adequate level of onboard observer coverage established, particularly in the exploratory/initial stages of deep-sea fishing. Furthermore, in order to increase the information available on VME, the resolution envisages that relevant expert groups of the Scientific Advisory Committee on Fisheries (SAC) [22], facilitated by the CPCs involved when required, collate and analyse all available data sources and provide advice on areas where VME indicator taxa are known or likely to occur, as well as expert views on potential additional measures (including threshold levels, move-on rules, level of scientific observer coverage) for the protection of VME indicator species. To this end, the resolution encourages CPCs to voluntarily establish research projects to collect relevant data.

The implementation of measures geared towards identifying sensitive areas is expected to contribute to preventing any SAI of fisheries on deep-sea VME in the Mediterranean Sea, as underpinned by relevant resolutions of the United Nations General Assembly on sustainable fisheries in 2004, 2006 and 2009[23].

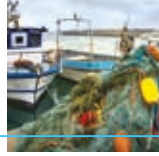
GFCM RESEARCH PROGRAMMES

GFCM research programmes were first introduced in 2014 with red coral. Since 2018, research programmes have been included, through specific recommendations, in the GFCM work plan for both the Mediterranean and the Black Sea (Table 17). They are implemented in those cases where an improvement in the sustainability and management of a specific fishery is expected to benefit from dedicated actions towards improving the quality and quantity of information on the resource, while addressing previously identified knowledge gaps and shortcomings in the relevant scientific/technical advice. Although not the first to be discussed, the first research programme to be implemented was that on rapa whelk (*Rapana venosa*)[24] fisheries in the Black Sea. Managed by the GFCM through the BlackSea4Fish project (Box 25) since 2019, it was closely followed by research programmes on

[22] The work of the SAC on spatial measures was initially carried out by two different working groups, the WGMPA and the Working Group on Vulnerable Marine Ecosystems (WGVME). Since 2019, the new Working Group on Essential Fish Habitats and Vulnerable Marine Ecosystems is expected to address issues on VME, marine protected areas (MPAs) and FRAs and essential fish habitats (EFH).

[23] A/RES/59/25, A/RES/61/105 and A/RES/64/72 - Sustainable fisheries, including through the 1995 Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, and related instruments.

[24] Recommendation GFCM/42/2018/9 on a regional research programme for rapa whelk fisheries in the Black Sea (geographical subarea 29).



Box 24. Determining the fishing footprint

The spatial extent of bottom fishing activities is also known as the fishing footprint. It is mapped based on the area of seabed fished by bottom contact gear at least once over a specified time period (Amoroso *et al.*, 2018). The final objective of this mapping exercise is to identify the location and intensity of current – and, if data are available, historical – bottom fishing activities with different types of gear. The identification of such fishing grounds is instrumental in assessing fishing effort in space, as well as the pressure exerted by bottom contact fisheries on benthic ecosystems. It also provides information useful for evaluating the effects on marine protected areas and fisheries restricted areas.

Owing to the acknowledged high vulnerability of deep-sea species and habitats to disturbances (Bell, Guijarro-Garcia and Kenny, 2019), including from fishing activities, this kind of analysis becomes particularly important in assessing, if and where, significant adverse impacts (SAI) from bottom fisheries are experienced by ecosystems, particularly vulnerable marine ecosystems (VMEs). The importance lies as much in where fishing occurs as in where fishing does not occur. The latter information, indeed, allows for the identification of pristine, previously unfished areas that may be eligible for protection by special management measures aimed at preventing any SAI on VMEs and at preserving marine biodiversity.

Most regional fisheries management organizations with competence over deep-sea fisheries have already formulated rules guiding deep-sea fisheries and several have undertaken the task of mapping their deep-sea fishing footprint (Bell, Guijarro-Garcia and Kenny, 2019). The GFCM has recently launched the very same process. According to endorsed protocols, contracting parties and cooperating non-contracting parties (CPCs) with vessels involved in deep-sea bottom fisheries are required to submit comprehensive maps of existing deep-sea bottom fishing areas (exploited at least within a five-year period prior to present) to the GFCM Secretariat, who will, in turn, produce composite maps, preferably by gear type, of the existing deep-sea bottom fishing areas within the GFCM area of application. Priority is given to bottom trawl fisheries at depths below 300 m.

The identification of such a deep-sea bottom fishing footprint will enable the implementation of an exploratory deep-sea bottom fishing protocol to ensure that exploratory or new deep-sea fishing activities carried out in previously unfished areas are only allowed to expand at a rate consistent with the knowledge and management capacities of that fishery.

The main foundation for a useful mapping exercise is the availability of high-resolution (vessel monitoring system (VMS)/automatic identification system (AIS)) spatial data regarding the fishery in question. Coarse resolution has been found to overestimate the footprint in a context where activities may be targeting very specific areas. The success of the exercise thus lies in the availability of such data for the fisheries involved, with a high preference for high-resolution VMS data provided by CPCs to the fishing vessels of the relevant categories.

In a first pilot phase, and based on existing recommendations (see main text), the GFCM is working on the deep-sea fisheries targeting two deep-water red shrimp species, i.e. the giant red shrimp (*Aristaeomorpha foliacea*) and the blue and red shrimp (*Aristeus antennatus*) in the central and eastern Mediterranean. The preliminary outcome consists of a composite map overlaying AIS information for some fleets and local ecological knowledge information for other fleets to indicate the general locations where these fishing activities occur. The work is being finalised by means of in-depth analyses of high-resolution AIS data, where available. This approach will be complemented by the results of a multicriteria decision analysis, applied to estimate fishing pressure where high-resolution VMS/AIS spatial data are not available, towards obtaining a first footprint for the deep-water red shrimp fishery.

Box 25. The BlackSea4Fish project

The BlackSea4Fish project was established in 2016 to contribute to the sustainable management of Black Sea fisheries by providing scientific and technical support to the GFCM's work in the region and coordinating priority activities of both the GFCM Subregional Group on Stock Assessment in the Black Sea (SGSABS) and the Working Group on the Black Sea (WGBS).

By bridging gaps at the regional level, the project provides the WGBS with the necessary resources to efficiently execute its priority actions, supporting the implementation of the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries and promoting training opportunities and capacity-building actions (GFCM, 2020a).

The project supports Bulgaria, Georgia, Romania, the Russian Federation, Turkey, Ukraine and the European Union in fulfilling their objectives with regard to Black Sea fisheries through organizing activities in line with agreed work plans, while benefiting from the technical and, as appropriate, financial/in-kind contributions of the countries involved.

The BlackSea4Fish project consists of five core objectives illustrated in the figure below.

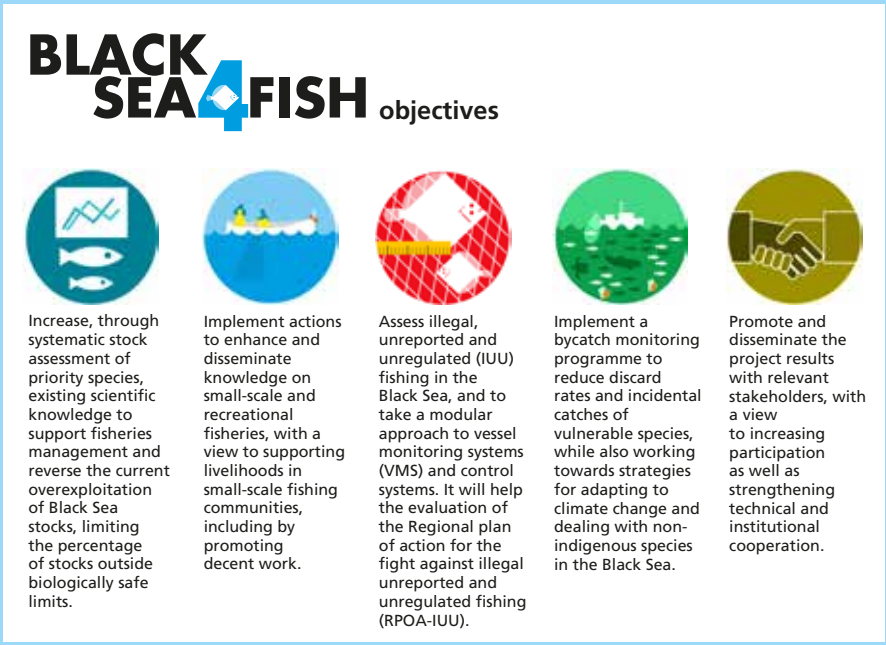
The project fulfils these objectives in a variety of ways, including by:

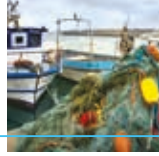
- securing external experts to address priority topics and carry out ad hoc studies;
- supporting the participation of Black Sea scientists in the SGSABS and in other WGBS or GFCM meetings and activities;
- coordinating and supporting the launch and implementation of relevant mid-term strategy activities, such as surveys-at-sea, vessel monitoring and control systems, socio-economic surveys and bycatch monitoring programmes;
- organizing new ad hoc activities in response to knowledge gaps identified by the WGBS, aimed, in particular, at improving stock assessments and knowledge of Black Sea fisheries;
- promoting training opportunities and capacity-building actions; and
- managing initiatives for outreach and the dissemination of project results.


© Saadet Karakulak

The non-indigenous rapa whelk ready to be measured, weighed, aged and sexed after being caught during the autumn survey-at-sea

The main achievements of the 2018–2020 period (GFCM, 2020a) include the organization of data preparation and stock assessment meetings, technical work on age reading, providing training in a number of stock assessment-related topics, a socio-economic survey, bycatch monitoring in Turkey and Ukraine and initiating work on a Black Sea scientific database. In 2018 and 2020, the BlackSea4Fish project assisted with the implementation of hydro-acoustic surveys of Black Sea anchovy (*Engraulis encrasicolus ponticus*) in Georgia (2018 and 2020) and in Turkey (2020), using standardized methodologies. In addition, 2020 saw the launch and completion of the first Black Sea standardized scientific survey-at-sea, with the aim of estimating the distribution, abundance, size and age structure of the non-indigenous rapa whelk (*Rapana venosa*) in the basin, carried out simultaneously by six partners in five coastal countries – Bulgaria, Georgia, Romania, Turkey and Ukraine.





European eel (*Anguilla anguilla*)[25] and red coral (*Corallium rubrum*)[26], both launched in 2020, and the planning of a similar initiative for blue crab (*Portunus segnis* and *Callinectes sapidus*)[27].

In all cases, the core principle is to take full advantage of ongoing research at the country level by providing a platform for coordination and filling the gaps with new activities and/or capacity-building support, generally aimed at providing the scientific basis for the determination of the most appropriate management measures.

Rapa whelk in the Black Sea

The rapa whelk is a non-indigenous species originating from the western Pacific, first observed in the Black Sea in 1947. Since then, the population of this gastropod has become established and expanded greatly, representing a significant revenue source for Black Sea countries, particularly for small-scale fishers. Massively exported to its native east Asia, the rapa whelk is currently fished close to its maximum sustainable limit. Previous efforts to curb, or even eradicate, its population, have thus evolved into policies to exploit its stock while controlling its biomass and providing for the multimillion-dollar market developing around it. The research programme on rapa whelk fisheries in the Black Sea was thus established by Recommendation GFCM/42/2018/9[28] and launched in 2019, under the coordination of the BlackSea4Fish project (Box 25). Its specific objective is to collect data on fishing activities in order to improve research and scientific knowledge valuable for achieving the sustainable exploitation of rapa whelk and maintaining the stock at MSY levels, as well as protecting the socio-economic viability of rapa whelk fisheries. Its outcomes are expected to offer support to the Working Group on the Black Sea (WGBS) by improving the scientific, technical and socio-economic knowledge of this newly established fishery.

The research programme is designed to address the above-mentioned objectives through six main aspects corresponding to six work packages:

- Work Package 1. Biology and ecology, including studies on size, genetics, density, abundance, biomass, recruitment, growth, reproduction, physiology and interactions with other species, environmental parameters influencing its lifecycle, preferred habitats and feeding behaviour.
- Work Package 2. Fishery-independent data collection: carried out through biannual standardized beam trawl surveys-at-sea collecting information on biomass and abundance indices and on the size/age distribution in all Black Sea countries. The first standardized beam trawl survey was completed in October 2020 by six partners in five countries (Bulgaria, Georgia, Romania, Turkey and Ukraine).
- Work Package 3. Fishery-dependent data collection: biological sampling of catch, bycatch and fishing effort, carried out at landing ports and through onboard observers.
- Work Package 4. Stock assessment: investigation of the methodologies used for assessing the status of rapa whelk, including through the compilation of historical data.
- Work Package 5. Socio-economic elements: socio-economic survey carried out to develop economic indicators and understand external aspects affecting the fishery and its economic sustainability.
- Work Package 6. Management proposals: testing the effects of possible management measures through management strategy evaluation (MSE).

European eel in the Mediterranean Sea

On the basis of the requests of GFCM Recommendation GFCM/42/2018/1[29] and the discussion held by the 2018 Working Group on the management of European eel, a concept note was developed by relevant experts outlining a research programme on European eel, to be carried out as a concerted action, joining the forces of ongoing research activities between nine partners, including research institutes/universities and relevant administrations of interested countries. The main aim of the research programme is to

[25] Recommendation GFCM/42/2018/1 on a multiannual management plan for European eel in the Mediterranean Sea.

[26] Recommendation GFCM/43/2019/4 on a management plan for the sustainable exploitation of red coral in the Mediterranean Sea.

[27] Recommendation GFCM/42/2018/7 on a regional research programme on blue crab in the Mediterranean Sea.

[28] Recommendation GFCM/42/2018/9 on a regional research programme for rapa whelk fisheries in the Black Sea (geographical subarea 29).

[29] Recommendation GFCM/42/2018/1 on a multiannual management plan for European eel in the Mediterranean Sea.

devise a coordinated framework for the collection, collation and analysis of data and for the assessment and management of the resource with a view to laying the foundations for a long-term multiannual management plan for European eel in the Mediterranean.

The research programme has five specific goals, each corresponding to a work package, within which research teams share methodologies, data and expertise, as follows:

- Work Package 1. Identify and evaluate management and protection measures for stock recovery.
- Work Package 2. Establish a common framework for long-term monitoring of the European eel in the Mediterranean.
- Work Package 3. Collect, collate and update data concerning eel fisheries, eel habitats, biological and ecological features of local eel stocks and eel trade across the Mediterranean region, including in all coastal, transitional and inland waters.
- Work Package 4. Establish a common framework for assessing European eel stocks at different scales in the Mediterranean.
- Work Package 5. Establish a coordination framework and a national and international network of European eel experts and projects around the Mediterranean for future interactions, involving the transfer of knowledge through capacity-building activities.

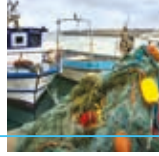
The research programme was launched in June 2020 and is expected to last 21 months. It is managed by the GFCM Secretariat and includes researchers and national administrations from Algeria, Albania, Egypt, France, Greece, Italy, Spain, Tunisia and Turkey, as well as two external, internationally renowned scientific experts forming the core of an advisory board.

Red coral

The implementation of a GFCM research programme on red coral was first proposed by experts in early 2014 in order to fill gaps in the knowledge of different traits of red coral life history in various countries and to support fisheries management. The results of such a research programme were considered instrumental for the SAC to provide further advice on the status of red coral populations and on the management of its fishery. A first concept note was thus developed in late 2014 by independent experts in coordination with the GFCM Secretariat; it was finalized and approved in 2019. The research programme consists of five main actions, as described below:

- Action 1. Fishery dependent/independent data acquisition and data compilation: aimed at investigating harvested red coral populations by means of data collected through fishing activities by onboard scientific observers and remotely operated vehicle (ROV) surveys (or deep-sea diving).
- Action 2. Pilot phase for traceability, certification and monitoring, control, surveillance (MCS) systems: aimed at compiling information on existing traceability mechanisms for fishery products in Mediterranean countries and at providing the basis for the implementation of a pilot project on the traceability of coral colonies collected within the GFCM area of application, from the landing point to the dealer (see Box 23).
- Action 3. Ex-situ laboratory analyses based on the collection of samples of live red coral: aimed at performing studies on reproduction, genetics and growth using small portions of non-commercial red coral fragments collected by the onboard observers (or deep-sea divers) in Action 1.
- Action 4. Stock assessment and recovery dynamics: aimed at developing suitable stock assessment models for red coral, as well as studying the dynamics and timing of the recovery of harvested populations, including from MPAs and no-take areas.
- Action 5. Socio-economic analysis of the red coral fisheries in the GFCM area of application: aimed at carrying out a study to define the socio-economic structure of red coral fisheries across the GFCM area of application while considering the wide heterogeneity of Mediterranean countries.

The research programme was launched in October 2020 with an online coordination meeting that aimed at consolidating the network of experts and discussing the methodology for data collection to be used during the programme. Its first phase involves the collaboration of researchers and national administrations from Algeria, Croatia, France, Greece, Spain and Tunisia, as well as of independent experts.



Blue crab in the Mediterranean Sea

Two large non-indigenous crab species, the American blue crab (*Callinectes sapidus*) and the blue swimming crab (*Portunus segnis*) – known collectively as "blue crab" – have been present in the Mediterranean since at least the first half of the twentieth century. The two species have followed different pathways of introduction: *P. segnis* most likely entered through the Suez Canal, while the appearance of *C. sapidus* has been attributed to a variety of possible vectors, including ballast waters. The appearance and establishment of both species around the Mediterranean has triggered a similar sequence of reactions. Initially, concerns were raised over both conservation (e.g. related to the quick expansion of these species and potential impacts on local ecosystems) and their negative interactions with existing fisheries (e.g. depredation and impacts on existing artisanal fishing gear). The development of dedicated strategies to control the populations and commercialize the catch (e.g. designing tailor-made fishing gear and analysing potential internal or external markets) followed. With this in mind, GFCM Recommendation 42/2018/7[30] sets the objectives of a research programme aimed at obtaining all the information necessary to properly evaluate the status of blue crab populations and to design strategies to develop targeted fisheries. In this way, as with the rapa whelk, fisheries could act as a tool to keep blue crab populations under control while providing opportunities for the fishing sector. The research programme consists of six work packages:

1. Work Package 1. Biology and ecology, including the collection of information on biological, ecological and behavioural characteristics of the two species of blue crab across their geographical distribution ranges.
2. Work Package 2. Fishery-independent data collection: carried out through at least annual surveys-at-sea to collect information on biomass and abundance, as well as on size composition, ideally including also environmental information not usually available from fisheries data, such as water temperature and salinity.
3. Work Package 3. Fishery-dependent data collection: collection of information, such as landings, landing composition by target species, size structure of landings, effort (number of boats and their characteristics, number of days/hours worked, etc.) and gear used, through onboard sampling by observers, sampling at landing ports or self-reporting.
4. Work Package 4. Stock assessment, aimed at establishing common stock assessment methods to be applied throughout the distribution area of blue crab; this work package is a priority for the long-term monitoring of stocks, making use of the information collected within other work packages.
5. Work Package 5. Blue crab fisheries, fishing technology, socio-economic elements and value chain: seeks to determine the basic elements guiding the evolution of fishing gear used for this species and to improve gear selectivity, while taking into account socio-economic aspects and the value chain.
6. Work Package 6. Management proposals: seeks to involve all relevant actors in a review of current local management measures towards setting common management objectives in line with relevant regional frameworks and implementing decisions based on local/regional biological characteristics.

The research programme on blue crab will be launched in 2021 and is expected to feature the collaboration of partners from all Mediterranean subregions, particularly from those countries where blue crab fisheries are already developed to various degrees, such as France, Egypt, Greece, Italy, Tunisia and Spain.

SPATIAL MANAGEMENT

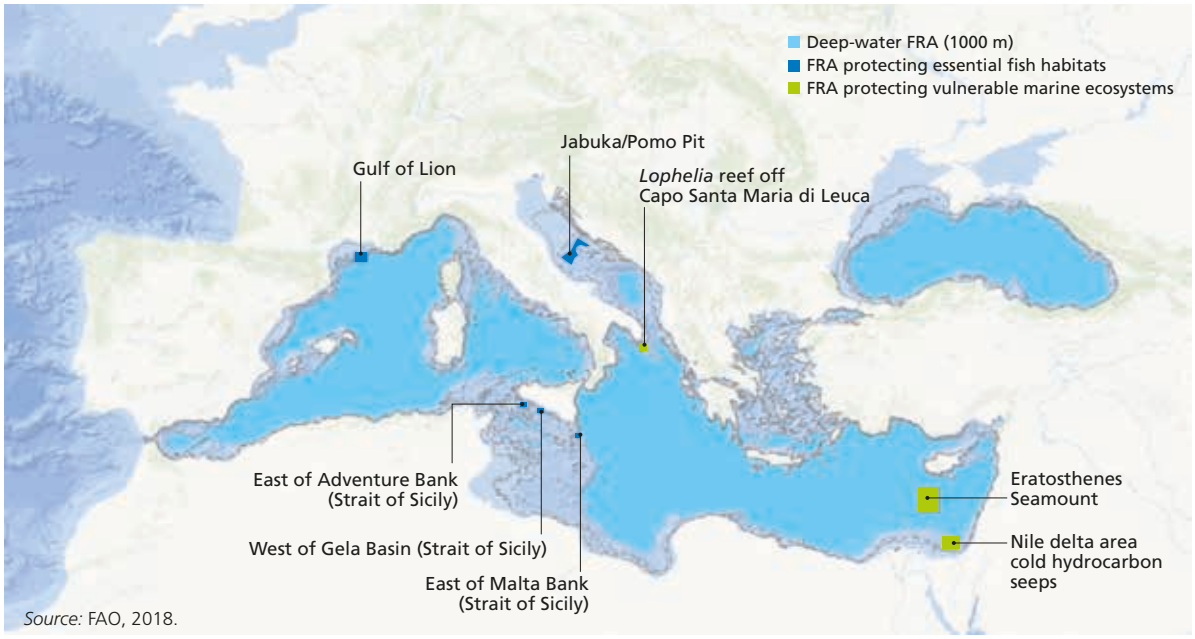
Overview of GFCM spatial management measures

Current spatial management measures

The GFCM has been promoting the establishment of a series of spatial fisheries restrictions and regulations within well delimited areas of the Mediterranean and the Black Sea (GFCM, 2012, 2014, 2015). To date, nine FRAs have been established by the GFCM, including one large deep-water FRA below 1 000 m. Fisheries restricted areas aim to protect EFH and/or sensitive habitats of high ecological value, such as VME, from any SAI of fishing activities (FAO, 2009) (Figure 92, see also detailed description in FAO, 2018). Spatial fishing restrictions addressing

[30] Recommendation GFCM/42/2018/7 on a regional research programme on blue crab in the Mediterranean Sea

FIGURE 92. Map of GFCM fisheries restricted areas



Source: FAO, 2018.

more coastal areas have also been implemented, often in conjunction with temporal ones, and included in multiannual management plans (Table 17), which often also encourage CPCs to establish temporal or permanent FRAs in their territorial waters as a measure towards assisting the recovery of stocks in overexploitation.

Monitoring of fisheries restricted areas

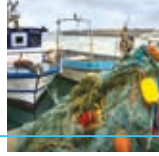
The importance of establishing proper scientific monitoring plans to assess the effectiveness of existing and future FRAs, both inside the FRAs and in adjacent areas, has recently been underlined in relevant GFCM meetings. In order to secure evidence for the contribution of closures such as FRAs to overall conservation and sustainability objectives, it is essential to set up adequate and tailored scientific monitoring plans from the outset. With this aim, the most recent meeting of the Working Group on Marine Protected Areas (WGMPA) in 2019 recommended that any future FRA proposal include a clear description of the objective(s) of the FRA and a scientific monitoring plan to evaluate the progress made towards its/their achievement, ideally included within the framework of a multiannual management plan as well.

Regarding already established FRAs for the protection of EFH, the assessment of their efficacy should focus on key affected priority species, and monitoring should be based on stock assessment and simulation tools such as MSE.

In order to facilitate the evaluation of FRAs protecting EFH, the following elements should be included in prospective monitoring plans:

- regular collection of fishery-independent data, by means of surveys-at-sea, with a focus on the key stocks protected by the FRA;
- regular collection of fisheries-related data, in accordance with the GFCM Data Collection Reference Framework, with a focus on the key stocks protected by the FRA;
- comprehensive socio-economic data collection aimed at assessing the effects of changes in the volume and composition of the landings of the fisheries affected by the FRA;
- collection of local ecological knowledge from fishers and stakeholders directly affected by the FRA; and
- formulation of regular advice on the status of fisheries affected by the FRA by the existing expert groups (e.g. the Working Groups on Stock Assessment and the Working Group on Management Strategy Evaluation), based on the information above.

The scientific monitoring plan in place in the Jabuka/Pomo Pit FRA (see also page 114) can be considered exemplary for its assessment of the effectiveness of FRAs in protecting EFH and in improving the status of priority species (Box 26).



Box 26. The case of the Jabuka/Pomo Pit fisheries restricted area

The Jabuka/Pomo Pit fisheries restricted area (FRA) is considered an example of best practice in transnational cooperation and in the integration of the views of fishers and stakeholders in the implementation of spatial protection measures. Although the FRA was established by the GFCM in 2017, different measures had already been implemented by one or both of the two main countries, Croatia and Italy, on their fleets operating in the area.

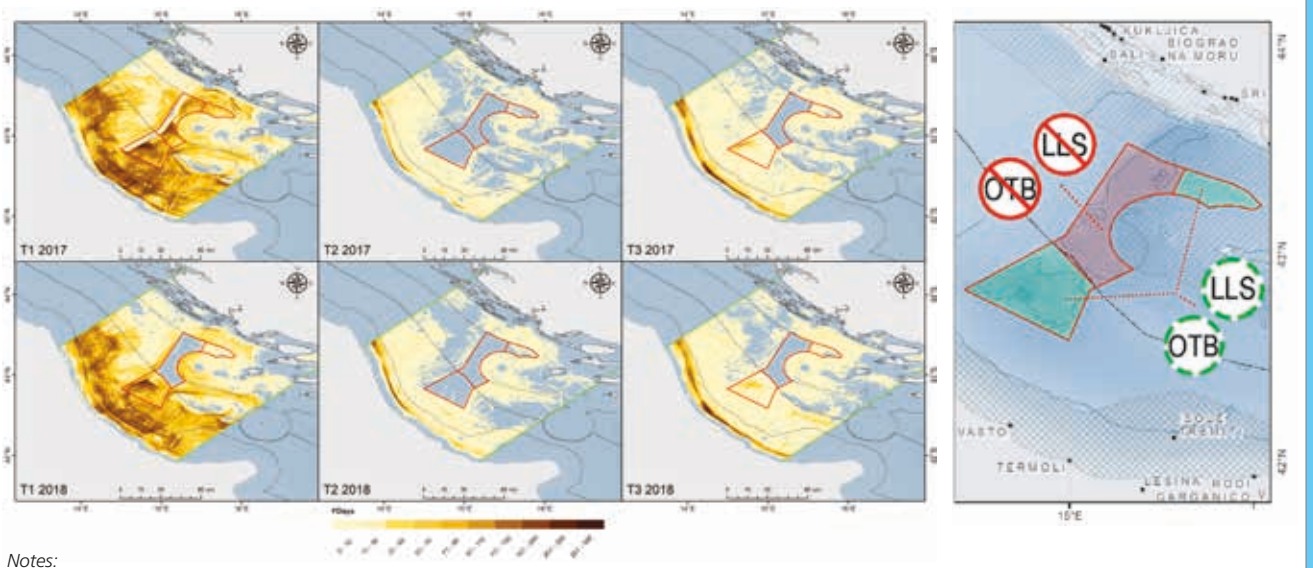
This FRA is also the first to be accompanied by a comprehensive scientific monitoring plan. The initiative of a monitoring plan for the Jabuka/Pomo Pit FRA was proposed by the Study Group on Jabuka/Pomo Pit of the FAO AdriaMed regional project in early 2018 and subsequently approved by the Scientific Advisory Committee on Fisheries and the GFCM. The main objective of the monitoring plan, over the period 2018–2020, was to assess the effectiveness of the FRA in: i) contributing to the rebuilding of stocks in the Adriatic Sea through the protection of essential fish habitats; ii) protecting vulnerable marine ecosystems in the area; and iii) increasing the densities of organisms in term of biomass and abundance within the FRA.

The scientific monitoring plan was designed to rely on activities already in place, as well as on existing historical datasets to be made available to the Jabuka/Pomo Pit AdriaMed Study Group and additional monitoring and surveys. Examples of such activities and datasets include expanded scientific surveys-at-sea, spatial information on fishing effort and socio-eonomic data. The monitoring plan thus entails the scientific analysis of the collected data with an aim to quantitatively determining the effects of the closure and includes, among other aspects, an assessment of important commercial stocks – e.g. European hake (*Merluccius merluccius*), Norway lobster (*Nephrops norvegicus*), deep-water rose shrimp (*Parapenaeus longirostris*) and blackbellied angler (*Lophius budegassa*) – and a spatial and socio-economic analysis of authorized fishing fleets.

The initial scientific evidence gathered is promising, showing higher abundance and densities of the main commercial species (e.g. European hake, Norway lobster, and deep-water rose shrimp) inside the FRA. Moreover, in general in GSA 17 (northern Adriatic Sea), the overall perception, including of fishers, is that the FRA is contributing to the recovery of the stocks. In more detail, preliminary results of importance, as discussed in the AdriaMed working groups, include:

- Preliminary analysis of scientific surveys-at-sea revealed clear indications of the presence of higher densities and abundances of juvenile European hake, Norway lobster and deep-water rose shrimp within the FRA and in some adjacent areas.
- Assessments of the status of European hake since the establishment of the FRA reveal a lower exploitation rate and a slight increase in spawning stock biomass.
- Preliminary analysis of the spatial movements of authorized fishing vessels based on automatic identification system (AIS) data confirms a shift in the activity of some fishing fleets to the borders of the closed area, suggesting an early confirmation of a possible spillover effect from the FRA, i.e. the net movement of adults into adjacent fishing grounds.

Activity of bottom trawlers in the Pomo/Jabuka Pit area derived from the analysis of AIS data



Notes:

From top left to bottom right, the activity of fishing vessels in yearly quarters (T1, T2, T3), beginning with the first quarter of 2017. The activity of fishing vessels is expressed as the total number of fishing days, with greater colour intensity corresponding to a higher number of fishing days.

The red outline delimits the Pomo/Jabuka Pit FRA, which includes the central part (zone A), where bottom fishing has been banned throughout the year for both bottom trawlers (OTB) and set longlines (LLS) since the second quarter of 2017 (T2 2017) and the marginal areas (B and C) where bottom fishing has been banned only from 1 September to 31 October each year since the establishment of the FRA. The top left panel shows the activity of the fleet before the establishment of the FRA, while symbols overlaid in all other panels represent the management measures (total ban or partial ban) in place.

Analysis performed by A.N. Tassetti, C. Ferrà, E.N. Armelloni and G. Scarcella within the context of the AdriaMed Study Group on Jabuka/Pomo Pit.

Assessing the effectiveness of VME-FRAs established to protect different types of sensitive benthic habitats (e.g. cold-water coral assemblages, sponge fields, chemosynthetic communities) is particularly challenging, especially if monitoring plans were not foreseen from the start. For future FRAs, it will be important to plan specifically for the biological and ecological characteristics of the benthic habitat subject to protection, giving priority to non-destructive survey methods, such as those relying on the use of ROVs or gliders. Nonetheless, for VME-FRAs, adequately enforced compliance and MCS measures provide the most critical contributions to ensuring that FRAs are effective in their primary conservation objective, i.e. preventing SAI of fisheries to sensitive benthic habitats, such as VME.

When a particular FRA is established with more than one goal in mind, a combination of monitoring approaches should be pursued, taking into account the relative importance of the different objectives and potential tradeoffs.

In order to assess the level of implementation of any decision concerning FRAs at the national level and to ensure compliance and the prevention of IUU fishing, the GFCM, through its Secretariat, regularly enquires about the monitoring and supervision of FRA-related measures carried out by CPCs, through the use of questionnaires. A first questionnaire was shared with CPCs in 2013 when four FRAs existed and results were presented at the WGMPA (2014); a second questionnaire was submitted to CPCs in early 2020 and the results are currently being compiled and analysed.

Database of sensitive benthic habitats and species

The GFCM database of sensitive benthic habitats and species was developed and launched in 2020 as a scientific tool to support the work carried out on deep-sea benthic ecosystems and EFH. The development of such a database represents one of the steps taken by the GFCM towards improving the management of deep-sea fisheries and preventing any potential adverse impacts that they may have on VME (See also pages 117; Box 24).

The database was conceived as an online platform to showcase information on the distribution of VME indicator taxa, habitats and features in the Mediterranean Sea (GFCM, 2017b, 2018c), with the additional important aim of facilitating data analysis to identify possible priority areas for conservation purposes and to provide the SAC with scientific advice on VMEs. The database is hosted in a password-protected environment where data consultation dashboards and data diagnostic instruments are made available to experts, including through advanced filters and search criteria, providing basic geographic information system features and allowing for the analysis of aggregated data outputs and representations (Figure 93). Integrated instruments facilitating data consultation, visualization and analysis exist for users familiar with data analysis tools, allowing online execution of R code for advanced map plotting and spatial analysis of datasets present in the database.

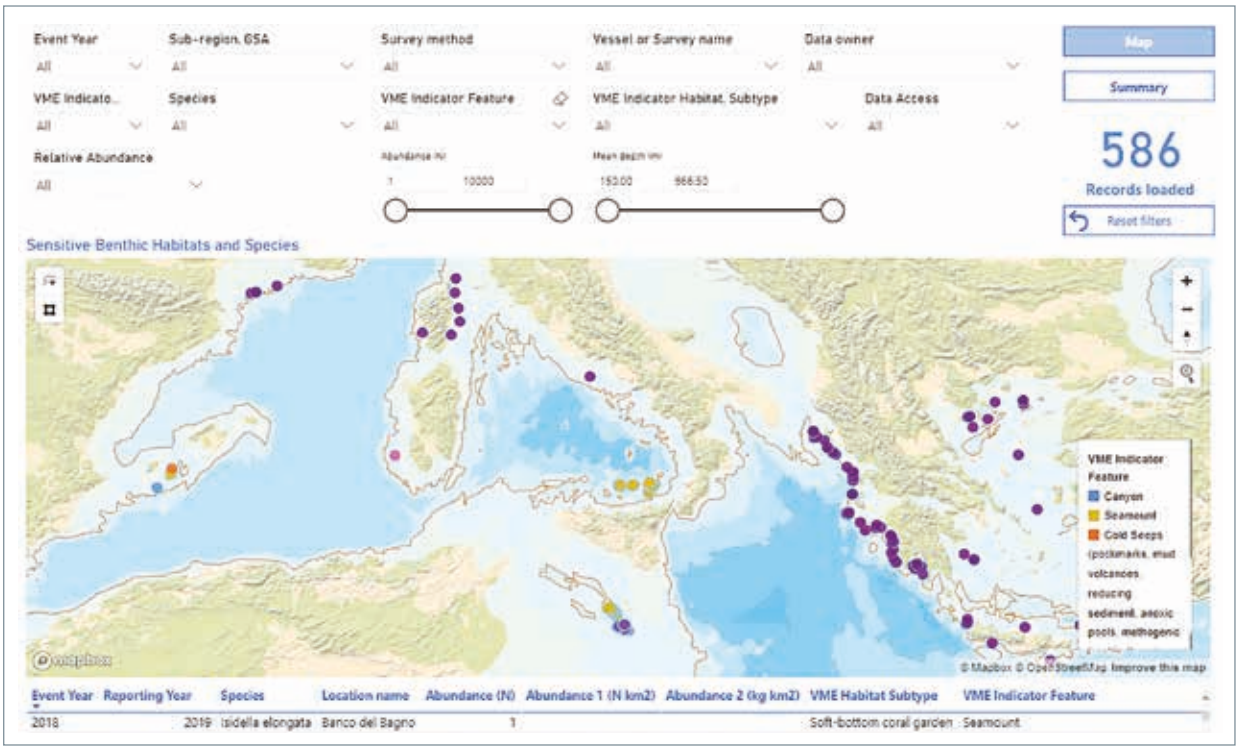
VME indicator taxa (see also the protocols for the protection of VME in the GFCM area of application; FAO, 2019c) include soft and hard corals, sponges, echinoderms, molluscs and other benthic organisms, most of which are included in relevant conservation lists, e.g. the IUCN Red List. At present, the database of sensitive benthic habitats and species includes only records (numbering almost 600) on the distribution of the alcyonacean bamboo coral (*Isidella elongata*), gathered by means of different types of surveys (ROV campaigns and fishery-independent surveys) between 1974 and 2018 across different Mediterranean subregions (Figure 93).

Data on other benthic species potentially forming VME will be added in the future, as they become available within the context of relevant GFCM technical bodies dealing with VME- and EFH-related issues.

CONCLUDING REMARKS

Significant advances have been made by the GFCM in the past six or so years in terms of managing fisheries resources in its area of application. Since the last issue of *The State of the Mediterranean and Black Sea Fisheries* (FAO, 2018), in particular, five new management plans have been approved, four existing ones have been revised, and four recommendations outlining new management measures or updating existing ones have been adopted. The effectiveness of these management plans is beginning to show for some fisheries, a notable example being

FIGURE 93. The GFCM database on sensitive benthic habitats and species



turbot in the Black Sea. To a certain extent, the same is also true for the European hake in the Mediterranean, an iconic species and one exhibiting some of the highest exploitation rates in the region (see Chapter 5). Although some important stocks of this species are showing signs of improvement, additional measures are required to ensure their sustainability, including through a dedicated regional management plan and the further implementation of spatial measures (notably EFH-FRAs), as highlighted by the four most recent annual sessions of the GFCM. Piked dogfish (*Squalus acanthias*) in the Black Sea was similarly highlighted at the last session of the GFCM as also requiring urgent implementation of management measures. For this species, the WGBS advised implementing a recovery plan in order to reverse the alarming trend in stock status shown by recent assessments, with a priority given to improving the information available on the stock, both fisheries-independent and fisheries-dependent (e.g. bycatch rates). Simulation tools, such as MSE, have been useful in assessing alternative management measures in order to set the most appropriate ones, as well as in understanding the resilience and potential recovery timeframes of specific resources under different management conditions. Since the technical and data requirements to obtain the best results from these tools are high, significant effort should be devoted to both facilitating the enhancement of capabilities across the region, as well as exploring the use of less data-thirsty, and thus more widely applicable, methodologies.

In order to provide a comprehensive scientific basis for the adoption of long-term management plans for some priority species, three GFCM research programmes were launched in 2020 to fill information gaps on rapa whelk, European eel and red coral, the latter two being of regional relevance. A fourth programme on blue crab is under way and a fifth, on common dolphinfish, has been requested. These programmes extend beyond merely the collection of additional or missing information; they provide a solid platform of cooperation and networking within the GFCM area of application on issues of common importance and facilitate the transfer of knowledge where needed, paving the way for effective cooperative management of shared resources.

The effective implementation of spatial management measures addressing vulnerable or sensitive habitats and ecosystems is of prime importance within the GFCM, as expressed

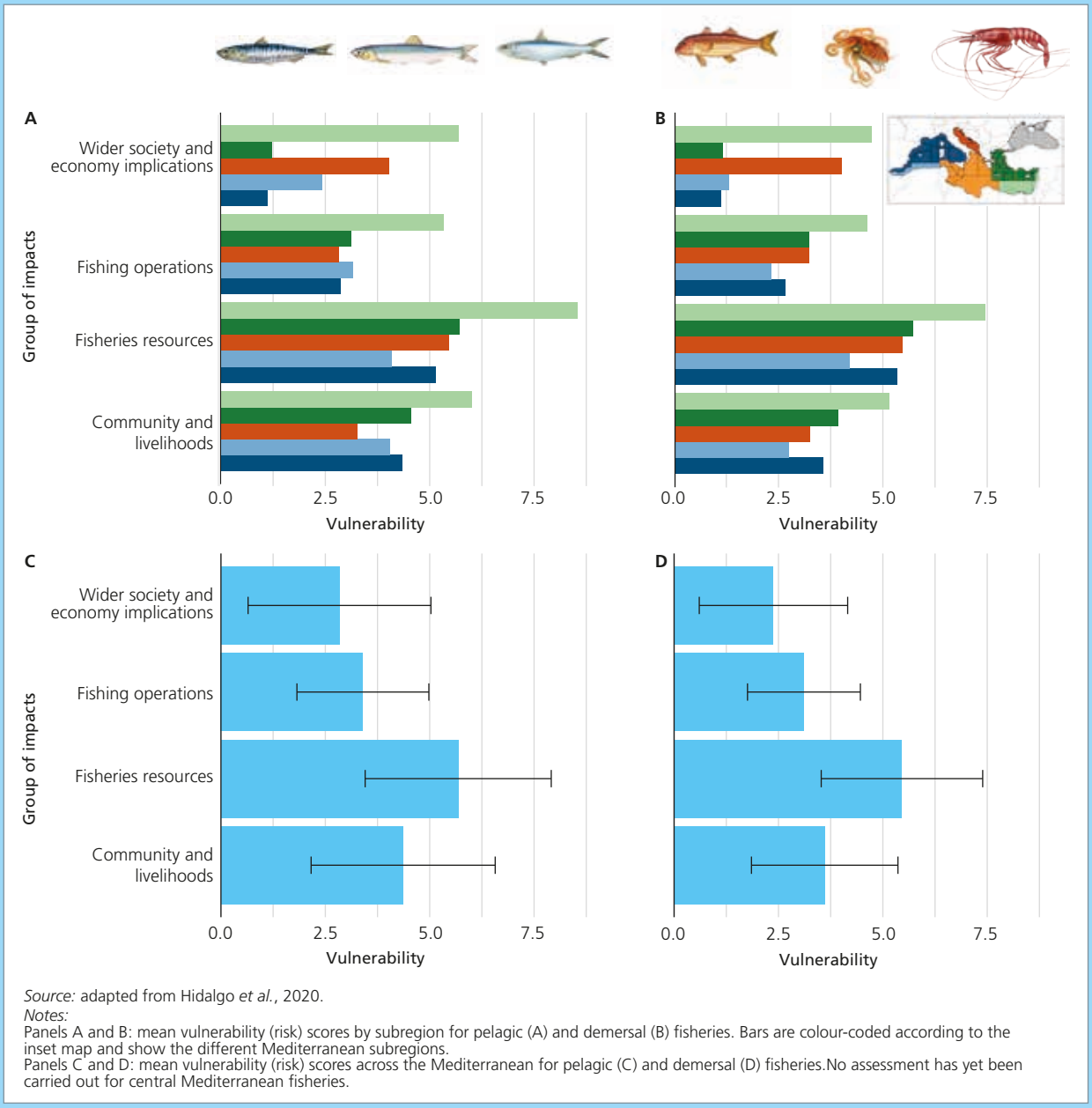
Box 27. Methodology for the assessment of fisheries vulnerability to climate change

The Mediterranean and the Black Sea show significant evidence of climate-induced changes. The region is warming 20 percent faster than the rest of the globe as a whole, and a diverse number of additional drivers are already having impacts in the region (MedECC, 2020). Current predictions identify this region as one of those likely to be most impacted in the future. Anticipated changes include increases in sea surface temperature and salinity, greater frequency of heat waves and other extreme events, and sea level rise, as well as a decrease in precipitation and changes in oceanographic circulation (Hidalgo *et al.*, 2018), and are expected to have a strong impact on habitats and ecosystems in general, and on fisheries and fisheries resources in particular.

In recognition of these daunting challenges, GFCM contracting parties and cooperating non-contracting parties have included as a target of the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries moving forward with an adaptation strategy for addressing the impacts of climate change and non-indigenous species on fisheries.

(cont.)

Preliminary vulnerability assessment of pelagic and demersal Mediterranean fisheries



Source: adapted from Hidalgo *et al.*, 2020.

Notes:

Panels A and B: mean vulnerability (risk) scores by subregion for pelagic (A) and demersal (B) fisheries. Bars are colour-coded according to the inset map and show the different Mediterranean subregions.

Panels C and D: mean vulnerability (risk) scores across the Mediterranean for pelagic (C) and demersal (D) fisheries.No assessment has yet been carried out for central Mediterranean fisheries.

Box 27. (continued)

The first steps of this strategy have been recently taken and involve assessments of the abundance and distribution of non-indigenous species in the area, as well as of their interactions with fisheries, including dedicated research programmes on blue crab (*Portunus segnis* and *Callinectes sapidus*) and rapa whelk (*Rapana venosa*) (see dedicated sections in this chapter), in addition to a number of actions towards assessing the vulnerability of fisheries to climate change.

Initial assessments of the vulnerability of the fisheries sector to climate change have been performed for different subregions based on a semi-quantitative approach and using existing expert knowledge. These initial assessments show several areas of concern associated with expected impacts on fisheries resources, fishing operations, livelihoods and overall socio-economic conditions. Notably, different impacts are foreseen across the various subregions and types of fisheries.

The next steps in the process include the validation of the initial vulnerability assessments, then extending the coverage of these assessments to all Mediterranean and Black Sea areas and discussing the development of a regional adaptation strategy to address the main priorities with all relevant stakeholders. These priorities need to take into account socio-ecological differences at the regional scale, providing adaptation responses focused on the most relevant impacts both on a given subregion and in relation to the entire Mediterranean and Black Sea area.

in the Agreement for the establishment of the General Fisheries Commission for the Mediterranean (GFCM, 2016). In this context, further work is required to expand existing measures, including those geared towards the consolidation of a network of EFH, as proposed in Resolution GFCM/41/2017/5, in order to provide protection that could also help to increase the production of species such as European hake. Important steps have already been taken towards this goal, with FRA monitoring plans put in place, and work in progress on the determination of the fishing footprint of certain fisheries, as well as on the identification of VME and detecting the presence of VME indicator species hotspots. Data availability, collection and collation are of paramount importance for the GFCM to continue advancing in this direction.

Interactions between fisheries and the environment are evermore critical in the face of climate change. Biodiversity and the distribution of fisheries resources are changing, non-indigenous species are becoming established and, in some cases, supporting large fisheries. Meanwhile, the vulnerability of fisheries and fishers to these changes in the surrounding environment (Box 27) and to the management measures adopted is increasing. All these dynamics need to be accounted for in the form of new and improved adaptive multiannual management plans incorporating not only socio-economic aspects, but also aspects related to the constantly changing climate.







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Glossary of terms and definitions

Terms and definitions are provided, when possible, as in the FAO TERM portal (FAO, 2020a). Additional terms and definitions are in line with references provided or as per GFCM practice.

Biomass (B): estimated total weight of a fish (used as a collective term to include molluscs, crustaceans and any other aquatic animal that is harvested) stock, or of some defined portion of it. It is measured in tonnes.

B_{LIM}: deterministic biomass limit, below which a stock is considered to have reduced reproductive capacity. B_{LIM} is a limit reference point.

B_{MSY}: biomass corresponding to maximum sustainable yield (MSY) from a production model or from an age-based analysis using a stock recruitment model. Often used as a biological reference point (BRP) in fisheries management, it is the calculated long-term average biomass value expected when fishing is at F_{MSY}. B_{MSY} is a target BRP.

B_{PA}: precautionary reference point for biomass (B or SSB) above which the stock is considered to be at full reproductive capacity. B_{PA} is a precautionary reference point generally determined so as to ensure a very low probability that the stock falls below B_{LIM} (e.g. 5 percent).

Biological reference point (BRP): a biological benchmark against which the fishing mortality rate or the abundance of the stock can be measured in order to determine its status. These reference points can correspond to limits or targets, depending on their intended usage:

i) **target BRPs:** correspond to a state of a fishery and/or of a resource that is considered desirable. Management action, whether during fishery development or the process of rebuilding a stock, should aim to bring to and maintain the fishery system at this level. In most cases, a target reference point (TRP) will be expressed as a desired level of output for the fishery (e.g. in terms of catch) or of fishing effort or of capacity and will be reflected as an explicit management objective for the fishery (e.g. B_{MSY} or F_{MSY});

ii) **threshold reference points (ThRps):** indicate that the state of a fishery and/or of a resource is approaching a TRP or a limit reference point (LRP), and that a certain type of action (usually agreed upon beforehand) must be taken. Fairly similar to the utility of an LRP, the specific purpose of a ThRp is to provide an early warning, reducing the risk that the relevant LRP or TRP is inadvertently passed due to uncertainty in the available information or an inherent inertia of management and industry systems. Contributing an additional precautionary element to the management set-up, ThRps might only be necessary for resources or situations involving particularly high risk. Threshold reference points used in *The State of Mediterranean and Black Sea Fisheries* include biomass precautionary limits (B_{PA}); and lastly

iii) **limit BRPs:** indicate the limit beyond which the state of a fishery and/or a resource is considered undesirable. Fishery development should be stopped before reaching it. If an LRP is inadvertently reached, management action should severely curtail or halt fishery development, as appropriate, and corrective action should be taken. Stock rehabilitation programmes should consider LRPs as the very minimum rebuilding targets to be reached before rebuilding measures are relaxed or the fishery is reopened. If an LRP is well established, the probability of reaching it inadvertently is very low and indeed below a formally agreed level. Limit reference points used in *The State of Mediterranean and Black Sea Fisheries* includes B_{LIM}.

Benchmark assessment: a complete analysis and review of all the information and methods currently used to provide advice on the status of a given stock, taking into consideration old and new data sources, as well as new or improved assessment models and assumptions.

Deep-sea fisheries (DSF): deep-sea fisheries are those that operate at great depths (up to 1 600 m). Deep-sea fisheries in the Mediterranean Sea are defined as: i) all fishing vessels above 15 m length overall (LOA) using bottom contact fishing gear to fish for giant red shrimp (*Aristaeomorpha foliacea*), blue and red shrimp (*Aristeus antennatus*) or golden shrimp (*Plesionika martia*); and ii) all fishing vessels above 15 m LOA using bottom contact gear (bottom trawls, longlines, gillnets and pots and traps) at depths deeper than 300 m or on offshore seamounts (FAO, 2019c).

Essential fish habitat (EFH): habitats identified as essential to satisfying the ecological and biological requirements of critical life history stages of exploited fish species (used as a collective term to include molluscs, crustaceans and any other aquatic animal that is harvested). These habitats may require special protection to improve the status of the stocks and secure their long-term sustainability.

Encounters and encounter rules: an encounter with a vulnerable marine ecosystem (VME) indicator taxa is defined as any catch of VME indicator taxa by any deep-sea fishery. Encounter rules stipulate that, following an encounter, the captain of the vessel shall report the encounter to the flag state, completing an ad hoc form and providing the following information: i) the position of the vessel; ii) the fishing characteristics of the vessel; and iii) the groups of VME indicator taxa encountered and the best estimates of their live weight. Encounter rules were endorsed by the GFCM in 2018, and GFCM contracting parties and cooperating non-contracting parties are encouraged to use them when implementing measures to prevent significant adverse impacts (SAI) of deep-sea fisheries on VMEs (Resolution GFCM/43/2019/6 on the establishment of a set of measures to protect vulnerable marine ecosystems formed by cnidarian (coral) communities in the Mediterranean Sea).

Exploratory deep-sea bottom fishing protocols: exploratory (or new) deep-sea bottom fishing occurs during the initial development phase of a deep-sea fishery when it begins to either operate in areas that have not previously been fished or to fish again in familiar areas after significant changes in gear or effort. Exploratory deep-sea bottom fishing protocols are established to ensure that exploratory or new deep-sea fishing activities are only allowed to grow at a rate consistent with the knowledge and management of that fishery and while always respecting existing vulnerable marine ecosystems (VMEs). Thus, vessels undertaking exploratory (or new) deep-sea bottom fishing shall be required to follow the exploratory deep-sea bottom fishing protocol, providing information on: i) the start and end points of each tow or set; ii) the fishing characteristics of the vessel, including the gear used; iii) the geographical subarea and the statistical grid where the exploratory deep-sea fishing occurred; iv) catch, bycatch, discards and fishing effort; and v) VME indicator taxa (if any) through the VME encounter protocol. These protocols were endorsed by the GFCM in 2018, and GFCM contracting parties and cooperating non-contracting parties are encouraged to use them when implementing measures to prevent significant adverse impacts (SAI) of deep-sea fisheries on vulnerable marine ecosystems (Resolution GFCM/43/2019/6 on the establishment of a set of measures to protect vulnerable marine ecosystems formed by cnidarian (coral) communities in the Mediterranean Sea).

Fishing mortality (F): a mathematical expression of the part of the total death rates of fish due to fishing. Fishing mortality is often expressed as a rate corresponding to the percentage of the population caught in a year.

$F_{0.1}$: the fishing mortality rate at which the marginal yield-per-recruit (i.e. the increase in yield-per-recruit in weight per one unit of increase in fishing mortality) is only 10 percent of the marginal yield-per-recruit of the unexploited stock. The fishing mortality rate at which the slope of the yield-per-recruit curve is only one-tenth the slope of the curve at its origin. $F_{0.1}$ is often used as a proxy for F_{MSY}.

F_{MSY}: the fishing mortality rate that, if applied constantly, would result in maximum sustainable yield (MSY). Used as a biological reference point (BRP), F_{MSY} is the implicit fishing mortality target of many regional and

national fishery management authorities and organizations. F_{MSY} is a target BRP.

Fisheries restricted area (FRA): a geographically defined area in which all or certain fishing activities are temporarily or permanently banned or restricted in order to improve the exploitation and conservation of harvested living aquatic resources or the protection of marine ecosystems in the GFCM area of application (FAO, 2008). There are two main types of FRAs: those protecting essential fish habitats (FRA-EFH) and those protecting vulnerable marine ecosystems (VMEs) and sensitive habitats in general (FRA-VME).

Local ecological knowledge (LEK): local ecological knowledge is the collective term used for the concepts and tools that can be used to understand relationships between local human populations and nature in terms of perception, use and management. In the context of fisheries management, LEK may include all the experience-based information sourced directly from fishers or stakeholders in general, on a particular subject, ranging from small-scale fisheries to non-indigenous species to climate change and more.

Marine protected area (MPA): a protected marine intertidal or subtidal area, within territorial waters or exclusive economic zones or in the high seas, set aside by law or other effective means together with its overlying water and associated flora, fauna, historical and cultural features. It provides degrees of preservation and protection for important marine biodiversity and resources; a particular habitat (e.g. a mangrove or a reef), or species or specific fish populations' life stages (e.g. spawners or juveniles) depending on the degree of use permitted. In MPAs, activities (of scientific, educational, recreational or extractive nature, including fishing) are strictly regulated and may be prohibited.

Maximum sustainable yield (MSY): the highest theoretical equilibrium yield that can be continuously taken (on average) from a stock under existing (average) environmental conditions without significantly affecting the reproduction process. Also referred to sometimes as potential yield.

Not elsewhere included (nei): In fisheries catch statistics, refers to catch data that cannot be linked directly to a state or species or fishing entity, for whatever reason. For example, gobies nei refers to any and all goby species that are not reported elsewhere and are aggregated for reporting purposes.

Non-deprecated stock assessment: a currently valid assessment for stock. If a validated assessment is not available for the most recent year, then one can refer to assessments performed in previous years, provided they are not older than three years for small pelagic species and not older than five years for demersal species.

Pescatourism: a relatively new concept at the intersection of tourism and fisheries. Its intention is to supplement the incomes of fishers and their families, while providing tourists with the opportunity to go out to sea and learn about fishing practices, the marine environment and the fishing tradition of the local community.

Precious corals: a term collectively describing the species of coral (species belonging to the Phylum Cnidaria with a skeleton made of calcium carbonate or limestone) whose skeletal axis is used as a gemstone to make ornaments and jewellery.

Significant adverse impacts (SAI): impacts that compromise ecosystem integrity (structure and function), i.e. by impairing the ability of populations to replace themselves, degrading the long-term natural productivity of the habitat, or causing considerable loss of species richness, habitat or community type, thus more significantly than just on a temporary basis (FAO, 2009).

Sensitive habitats: fragile habitats that are internationally recognized as ecologically important. They support important assemblages of commercial and non-commercial fish species and may require special protection.

Spawning stock biomass (SSB): the total weight of all the fish (both males and females) that contribute to reproduction within a population. Often conventionally defined as the biomass of all individuals older than age at first maturity or larger than size at first maturity, i.e. above the age or size class at which 50 percent of individuals are mature.

Vulnerable marine ecosystem (VME): a marine ecosystem that has the characteristics referred to in paragraph 42 and elaborated in the annex of the FAO *International Guidelines for the Management of Deep-Sea Fisheries in the High Seas* (FAO, 2009).

The State of Mediterranean and Black Sea Fisheries 2020

The 2020 edition of the flagship publication of the GFCM, *The State of Mediterranean and Black Sea Fisheries* provides a comprehensive overview of regional and subregional trends in Mediterranean and Black Sea fisheries.

As the third instalment of the report, the publication updates the data and information found in the previous editions, as well as offering notes and guidance on recently emerging issues, such as the effects of the COVID-19 pandemic. Presented in a clear and standardised manner and made available for the first time in an interactive format online, the report aims to provide objective, reliable and up-to-date information to a wide audience and support decision-making in fisheries.

Data and indicators of historically high quality gathered from GFCM contracting parties and cooperating non-contracting parties allow *The State of Mediterranean and Black Sea Fisheries 2020* to paint the most complete and detailed portrait of fisheries in the region to date. The report captures and organises the dynamic nature of this sector into seven chapters, each focusing on a different aspect of Mediterranean and Black Sea fisheries.

Classifying the region's fleet and capture fisheries production, the first two chapters provide a general survey of the vessels and marine species that make up the Mediterranean and Black Sea fisheries. Chapters three through six pivot towards specific aspects of the sector on which the GFCM dedicates much effort in guaranteeing the sustainability of fishing activities and protecting the health of vulnerable species. These chapters include figures and information on socio-economic characteristics, bycatch, the status of fisheries resources and small-scale fisheries. Finally, chapter seven summarizes the various multiannual management measures adopted by the GFCM since the last issue of *The State of Mediterranean and Black Sea Fisheries*, many of which have evolved from earlier related management plans, while others have arisen to address more recent developments.

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