Food and Agriculture Organization of the United Nations

General Fisheries Commission for the Mediterranean

The State of Mediterranean and Black Sea Fisheries 2022

Funded by the European Union

The State of Mediterranean and Black Sea Fisheries 2022

Food and Agriculture Organization of the United Nations
Rome, 2022

Required citation:
FAO. 2022. *The State of Mediterranean and Black Sea Fisheries 2022*. General Fisheries Commission for the Mediterranean. Rome. https://doi.org/10.4060/cc3370en

ISSN 2413-6905 [Print]
ISSN 2413-7049 [Online]

ISBN 978-92-5-137370-5

This publication has been produced with the assistance of the European Union. The contents of this publication are the sole responsibility of FAO and can in no way be taken to reflect the views of the European Union.

Cover photograph: ©GFCM/Pier Paolo Cito

Contents

Part 2. Management of Mediterranean and Black Sea fisheries

Tables, figures and boxes

Tables

Figures

Boxes

Foreword

The State of Mediterranean and Black Sea Fisheries provides the most comprehensive and up-to-date analysis of this crucial aquatic food production sector in our region, as well as the information necessary to review advances and identify challenges in achieving the sustainability of fish and fisheries in the Mediterranean and the Black Sea.

This 2022 edition of *The State of Mediterranean and Black Sea Fisheries* comes at a special moment in the history of the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO), as this year marks the seventieth anniversary of the entry into force of the Agreement establishing the GFCM. While celebrating this milestone, countries and partner organizations paused to reflect not only on the progress made over the past 70 years, but also on the organization's future direction as the GFCM embarked on its first year of implementing the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (GFCM 2030 Strategy). This edition provides foundations for these reflections and focuses attention on the most critical issues.

Fisheries have been tightly woven into the Mediterranean and Black Sea way of life for millennia. Dense populations along the coasts and high demand for fish products, which form a key element of the region's celebrated cuisines, have always made fishing a key source of livelihoods in the region. Fisheries not only provide for those who work at sea, but their benefits are spread along the value chain, creating economic opportunities for boat and net builders, fish mongers and fish processers, restaurant owners and tourism activities, among many others.

Beyond its rich human history with a long tradition of fishing activities, the Mediterranean and Black Sea region also hosts unique ecosystems. Unfortunately, however, these two seas are hotspots for various anthropogenic pressures, including climate change and plastic pollution, as well as the appearance and expansion of non-indigenous species, with more than a thousand of these species having been reported in the region.

These threats, coupled with pressures from fishing activities and external challenges, such as the COVID-19 pandemic and the ensuing economic crisis, pose a risk to the marine environment and to the thousands of livelihoods that depend on healthy seas and productive fisheries in our region. Fishers, particularly the

small-scale fishers who form the workforce's overwhelming majority, are an especially vulnerable population, and efforts are needed to support their resilience.

Fortunately, in its 70 years the GFCM has undergone an important evolution, laying down strong roots to grow into a modern, efficient and effective organization capable of addressing the social, economic and environmental challenges facing the sector today. Crucial to addressing these challenges is the strategic vision presented by the GFCM 2030 Strategy, which, in its first year of implementation in 2022, has already begun to bear fruit.

Therefore, in the year of the GFCM's seventieth anniversary, we must celebrate the progress made towards efficient management of fisheries, much of which is clearly outlined in this fourth edition of *The State of Mediterranean and Black Sea Fisheries*. The stakes are high and the objectives of the GFCM 2030 strategy are ambitious – as they should be – in order to preserve such an important sector. *The State of Mediterranean and Black Sea Fisheries 2022* provides the information needed to identify gaps, strengths and challenges, guiding key actions to be implemented and facilitating the design of efficient measures.

Roland Kristo
Chairperson
General Fisheries Commission
for the Mediterranean

Acknowledgements

The State of Mediterranean and Black Sea Fisheries 2022 was prepared by the staff of the Secretariat of the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO), under the overall direction of Miguel Bernal (Executive Secretary) with contributions from the following staff members (in alphabetical order): Ibrahim Abdelgawad (Junior Fisheries and Environment Specialist), Anna Carlson (Fishery Officer – Socioeconomic issues), Paolo Carpentieri (Fishery Resources Monitoring Specialist), Selvaggia Cognetti De Martiis (Fishery Information Management Specialist), Federico De Rossi (Data Compliance Officer), Roberto Emma (Data Analyst), Elisabetta Betulla Morello (Fishery Resources Officer), Elisa Moreno De La Cruz (Fishery Data Compliance Specialist), Aurora Nastasi (Fisheries and Environment Specialist), John Gabriel Ramirez Tellez (Stock Assessment Specialist), Margherita Sessa (Fisheries Liaison and Programme Officer), Constance Verlhac (Small-Scale Fisheries Specialist) and Henning Winker (Stock Assessment Frameworks Specialist).

The editing, graphics, layout and publishing were coordinated by Dominique Bourdenet (Knowledge Management Officer), with the assistance of Ysé Bendjeddou (Publications Coordinator), Matthew Kleiner (Junior Publications Specialist) and Alexandria Schutte (Knowledge Management Specialist). The publication also benefited from the expertise of Alex Chepstow-Lusty, who performed the technical editing, and Chiara Caproni, who developed the graphic concept, design and layout, with support from Chorouk Benkabbour, who contributed to the graphic design, and Yamrote Alemu Hailesselassie, who designed infographics. General communications around the publication were handled by Adèle Peenaert (Senior Communications Coordinator), Berna Çetin (Communications Specialist) and Intissare Aamri (Junior Communications Specialist). Sinziana Demian (Communications Specialist) prepared media materials and a video script, Evan Jeffries contributed to the development of key messages and Claudia Amico (Video Director and Producer) was responsible for video production.

Yessine Ben Arfa and Loretta Malvarosa are acknowledged for their inputs to the box on "Integrating socioeconomic data in fisheries management: a closer look at key fisheries" in Chapter 3. The national focal points involved in the monitoring programmes for discards and incidental catch of vulnerable species are recognized for their role in improving the knowledge available on bycatch in the Mediterranean and the Black Sea, which underpins the data

provided in Chapter 4. Thanks are extended to the MedBycatch project partners for their joint efforts to promote a thorough monitoring of incidental catch of vulnerable species in the region. Moreover, gratitude is expressed to the relevant staff of the FAO Fisheries and Aquaculture Division for their cooperation and support in ensuring that this report provides a solid source of information for the area.

Special thanks are due to the members of the GFCM Scientific Advisory Committee on Fisheries and of the GFCM Working Group on the Black Sea, as well as to all national administrations, universities, research institutes and individual experts for their contributions to the preparation of GFCM scientific advice. The donors who provided required funds to implement all technical activities underpinning the elaboration of this report are also recognized, in particular the European Union for its financial support to the preparation of this publication. A particular acknowledgement goes to Abdellah Srour, GFCM Executive Secretary from 2011 to 2021, who promoted the preparation of *The State of Mediterranean and Black Sea Fisheries* as a strategic tool to assist countries and experts in better understanding Mediterranean and Black Sea fisheries and to identify future challenges.

The cover photograph of Chapter 4 is a tribute to the life of David Salvatori, an extraordinary underwater photographer with a deep passion for the marine environment and with whom the GFCM had the opportunity to collaborate. The GFCM's materials will continue to feature his pictures, honouring his artistry and commitment to Mediterranean biodiversity.

Abbreviations and acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
BL ECA	BirdLife Europe and Central Asia
CDS	catch documentation scheme
COFI	Committee on Fisheries (FAO)
COP	Conference of the Parties (UNFCCC)
CPCs	contracting parties and cooperating non-contracting parties (GFCM)
DCRF	Data Collection Reference Framework (GFCM)
EFH	essential fish habitat
F	fishing mortality
F_{MSY}	maximum sustainable yield target
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
FRA	fisheries restricted area
FTE	full-time equivalent
GCF	gross cash flow
GFCM	General Fisheries Commission for the Mediterranean
GSA	geographical subarea (GFCM)
GT	gross tonnage
GVA	gross value added
ILO	International Labour Organization
ICCAT	International Commission for the Conservation of Atlantic Tunas
IMO	International Maritime Organization
IPC	International Planning Committee for Food Sovereignty
ISSCAAP	International Standard Statistical Classification for Aquatic Animals and Plants (FAO)
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)
IYAFA	International Year of Artisanal Fisheries and Aquaculture
kW	kilowatt
LIFE	Low Impact Fishers of Europe
LOA	length overall
MCS	monitoring, control and surveillance
MCRS	minimum conservation reference size
MEDASSET	Mediterranean Association to Save the Sea Turtles
MPA	marine protected area
MSY	maximum sustainable yield
ROV	remotely operated vehicle
RPOA-SSF	Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea
SAC	Scientific Advisory Committee on Fisheries (GFCM)

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
STB	standardized trade balance
TAC	total allowable catch
UNFCCC	United Nations Framework Convention on Climate Change
UNEP/MAP	Mediterranean Action Plan of the United Nations Environment Programme
VME	vulnerable marine ecosystem
VMS	vessel monitoring system
WGBS	Working Group on the Black Sea (GFCM)
WGSSF	Working Group on Small-Scale Fisheries (GFCM)
WHO	World Health Organization
WP	work package
WWF	World Wildlife Fund

Introduction and methodology

Fishing has always had a significant cultural, social and economic importance in the Mediterranean and the Black Sea, providing a key source of food while sustaining the traditions and livelihoods of many coastal communities.

Key features of the region's geography and human history continue to lend unique challenges, as well as opportunities, to fisheries and their management in the Mediterranean and the Black Sea. The semi-enclosed basins host a multitude of commercially important species that are often landed together by multispecies fisheries exploiting a variety of benthic and pelagic stocks of fish, molluscs and crustaceans. Stocks are shared by neighbouring industrial, semi-industrial and small-scale fisheries and by different countries, setting the context for necessary cooperation on scientific-based management of common resources. Indeed, the fishery sector plays an important connecting role in the region, maintaining the social fabric of many coastal communities. Mediterranean and Black Sea fisheries' 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.

However, 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 ecosystems risk compromising the sustainability of Mediterranean and Black Sea fisheries. Recent dramatic changes have altered the region's ecosystems, especially in the Black Sea over the past few decades, requiring urgent responses to these processes and stressors when managing fisheries in the region in line with an ecosystem approach to fisheries.

The General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO) is, *inter alia*, a knowledge-based organization committed to improving both the quantity and quality of data and information used to formulate sound scientific advice with a view to better supporting evidence-based decision-making to underpin the sustainability of Mediterranean and Black Sea fisheries.

This report is the fourth edition of the GFCM biennial series *The State of Mediterranean and Black Sea Fisheries*. The series was

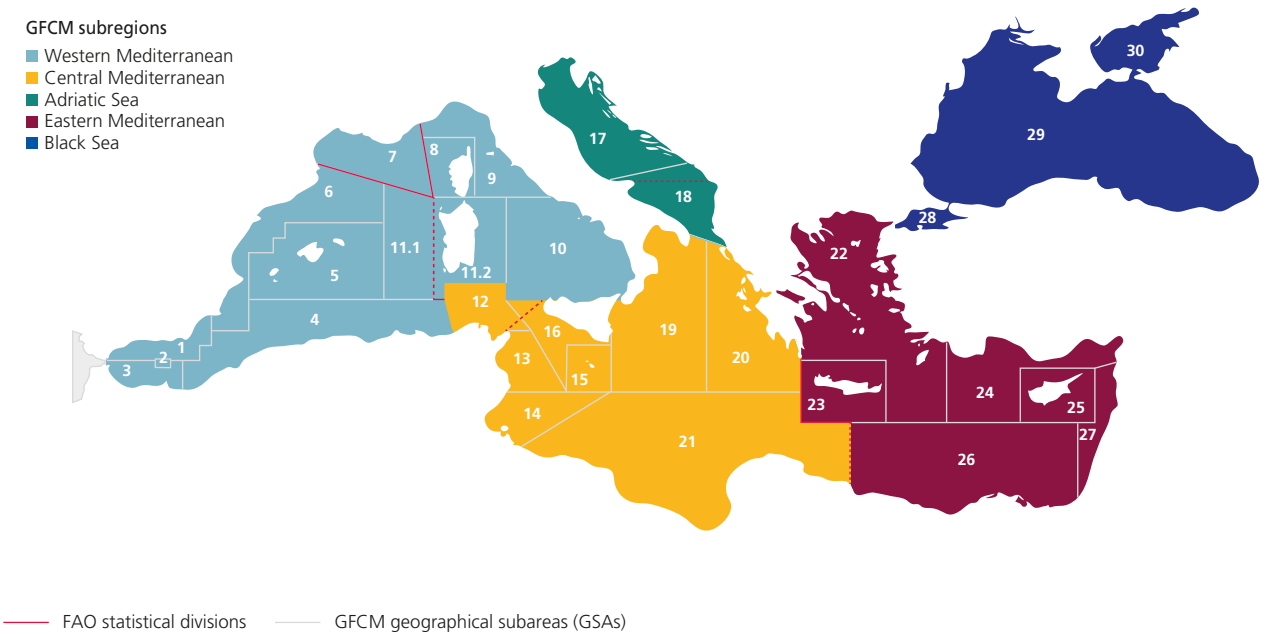
established to serve as a reference for the GFCM's membership and partners on the status of marine resources, ecosystems and fisheries in the Mediterranean and the Black Sea. It provides an essential information source on the main issues surrounding the fisheries sector in the region, as well as a key tool to monitor progress towards the main goals and objectives set by the GFCM (Box 1) and consequently to support 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 fisheries in the Mediterranean and the Black Sea, or FAO major fishing area 37.

The State of Mediterranean and Black Sea Fisheries 2022 is divided into two parts and consists of seven chapters. The first part provides an overview of status and trends in the region, describing the current composition of the fishing fleet (Chapter 1), the overall capture fisheries production (Chapter 2), the economic performance and socioeconomic 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, 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 the marine environment and ecosystems (Chapter 7).

The report presents data and information mostly gathered up to 2020, although when possible, 2021 is also accounted for. This information is based on data officially submitted by GFCM contracting parties and cooperating non-contracting parties (CPCs), in line with binding decisions (GFCM, 2021), through the online platform of the GFCM Data Collection Reference Framework (DCRF; Box 2), FAO official fishery statistics (e.g. FAO fisheries commodities production and trade statistics), the GFCM database on stock assessment form metadata, the STATLANT system of questionnaires developed by the FAO Coordinating Working Party on Fishery Statistics, 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 from official data submitted according to the DCRF fleet segments. 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. Data are also aggregated and analysed by species, in line with the lists of main species of commercial or conservation interest (available in Tables 1, 2 and 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 across the entire GFCM area of application (the Mediterranean and the Black Sea). At the subregional level – according to the

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



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. Southern Levant Sea
03. Southern Alboran Sea	09. Ligurian Sea and northern Tyrrhenian Sea	15. Malta	21. Southern Ionian Sea	27. Eastern Levant Sea
04. Algeria	10. Southern and central Tyrrhenian Sea	16. Southern Sicily	22. Aegean Sea	28. Marmara Sea
05. Balearic Islands	11.1. Western Sardinia 11.2. Eastern Sardinia	17. Northern Adriatic Sea	23. Crete	29. Black Sea
06. Northern Spain	12. Northern Tunisia	18. Southern Adriatic Sea	24. Northern Levant Sea	30. Azov Sea

Note: At its forty-fifth session in November 2022, the GFCM agreed to divide GSA 21 (Southern Ionian Sea) into three marine subareas. The subdivision of GSA 21 into GSAs 21.1, 21.2 and 21.3 will be applied in 2023.

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 scale, 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 the Black Sea, including on fishing and fisheries-related monitoring activities (GFCM, 2020a, 2020b). A brief preliminary analysis of the immediate impacts of the COVID-19 pandemic on Mediterranean and Black Sea fisheries was reported in *The State of Mediterranean and Black Sea Fisheries 2020*, (FAO, 2020a) while the data used in this edition reflect the changes that occurred within the fisheries sector during 2020, including due to the effects of the COVID-19 crisis, as described in several chapters, particularly those addressing socioeconomic indicators (Chapter 3) and the small-scale fisheries sector (Chapter 6) (see Box 10).

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

		Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
GFCM subregions →						
GFCM geographical subareas →		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, Türkiye	Bulgaria, Georgia, Romania, Russian Federation, Türkiye, Ukraine
Scientific name	Common name					
Pelagic species						
Engraulis encrasicolus	European anchovy	■	■	■	■	■
Sardina pilchardus	Sardine	■	■	■	■	
Sardinella aurita	Round sardinella	■	■		■	
Sprattus sprattus	European sprat					■
Trachurus mediterraneus	Mediterranean horse mackerel					■
Demersal species						
Aristaeomorpha foliacea	Giant red shrimp		■		■	
Aristeus antennatus	Blue and red shrimp		■		■	
Lagocephalus sceleratus	Silver-cheeked toadfish	■	■	■	■	
Merlangius merlangus	Whiting					■
Merluccius merluccius	European hake	■	■	■	■	
Mullus barbatus	Red mullet	■	■	■	■	
Mullus surmuletus	Surmullet	■	■		■	
Nephrops norvegicus	Norway lobster	■	■	■		
Pagellus bogaraveo	Blackspot seabream	■				
Parapenaeus longirostris	Deep-water rose shrimp	■	■	■	■	
Pterois miles	Devil firefish	■	■	■	■	
Rapana venosa	Rapa whelk					■
Scophthalmus maximus	Turbot					■
Sepia officinalis	Common cuttlefish			■		
Solea solea	Common sole			■		
*Squalus acanthias**	Piked dogfish					■
Squilla mantis	Spottail mantis shrimp			■		
Additional species						
Anguilla anguilla	European eel	■	■	■	■	
Corallium rubrum	Red coral	■	■	■	■	
Coryphaena hippurus	Common dolphinfish		■	■	■	
Sarda sarda	Atlantic bonito					■
Saurida lessepsianus	Lizardfish				■	

Note: * indicates species included in Appendix III (species whose exploitation is regulated) of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol) of the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention).

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

GFCM subregions →		Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
GFCM geographical subareas →		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, Türkiye	Bulgaria, Georgia, Romania, Russian Federation, Türkiye, Ukraine
Scientific name	Common name					
Alosa immaculata	Pontic shad					■
Aristeus antennatus	Blue and red shrimp	■				
Boops boops	Bogue	■	■	■	■	
Chamelea gallina	Striped venus			■		
Diplodus annularis	Annular seabream		■			
Eledone cirrhosa	Horned octopus	■		■		
Eledone moschata	Musky octopus			■		
Galeus melastomus	Blackmouth catshark	■				
Lophius budegassa	Blackbellied angler	■	■			
Micromesistius poutassou	Blue whiting	■				
Octopus vulgaris	Common octopus	■	■	■	■	
Pagellus erythrinus	Common pandora	■	■	■	■	
Raja asterias	Mediterranean starry ray	■				
Raja clavata	Thornback ray	■	■			
Saurida undosquamis	Brushtooth lizardfish				■	
Scomber japonicus	Pacific chub mackerel	■			■	
Scomber scombrus	Atlantic mackerel	■	■			
Sepia officinalis	Common cuttlefish	■	■			
Siganus luridus	Dusky spinefoot				■	
Siganus rivulatus	Marbled spinefoot				■	
Solea solea	Common sole				■	
Sphyraena sphyraena	European barracuda		■			
Spicara smaris	Picarel			■	■	
Trachurus mediterraneus	Mediterranean horse mackerel	■				
Trachurus picturatus	Blue jack mackerel	■				
Trachurus trachurus	Atlantic horse mackerel	■	■		■	

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

		Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
GFCM subregions →						
GFCM geographical subareas →		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, Türkiye	Bulgaria, Georgia, Romania, Russian Federation, Türkiye, Ukraine
Scientific name	Common name					
Callinectes sapidus	Blue crab	■	■	■	■	
Dalatias licha	Kitefin shark	■	■	■	■	
Dipturus oxyrinchus	Longnosed skate	■	■	■	■	
Etmopterus spinax	Velvet belly	■	■	■	■	
Galeus melastomus	Blackmouth catshark		■	■	■	
Hexanchus griseus	Bluntnose sixgill shark	■	■	■	■	
Mustelus asterias	Starry smooth-hound	■	■	■	■	
Mustelus mustelus	Smooth-hound	■	■	■	■	
Mustelus punctulatus	Blackspotted smooth-hound	■	■	■	■	
Myliobatis aquila	Common eagle ray	■	■	■	■	
Portunus segnis	Blue swimming crab	■	■	■	■	
Prionace glauca	Blue shark	■	■	■	■	
Pteroplatytrygon violacea	Pelagic stingray	■	■	■	■	
Raja asterias	Mediterranean starry ray		■	■	■	
Raja clavata	Thornback ray			■	■	■
Raja miraletus	Brown ray	■	■	■	■	
Scyliorhinus canicula	Small-spotted catshark	■	■	■	■	■
Scyliorhinus stellaris	Nursehound	■	■	■	■	
*Squalus acanthias**	Piked dogfish	■	■	■	■	
Squalus blainville	Longnose spurdog	■	■	■	■	
Torpedo marmorata	Marbled electric ray	■	■	■	■	
Torpedo torpedo	Common torpedo	■	■	■	■	
Fistularia commersonii	Bluespotted cornetfish				■	
Marsupenaeus japonicus	Kuruma prawn				■	
Metapenaeus stebbingi	Peregrine shrimp				■	
Scomberomorus commerson	Narrow-barred Spanish mackerel				■	

Note: * indicates species included in Appendix III (species whose exploitation is regulated) of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol) of the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention).

Box 1. The GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea: five targets, two seas, one vision

The GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (GFCM 2030 Strategy)[1] offers a common vision and guiding principles for an ambitious ten-year commitment to achieving sustainable fisheries and aquaculture in the region and marks the beginning of a critical decade of development for the two sectors.

Far more than a purely aspirational vision, the GFCM 2030 Strategy reaches towards clearly defined aims and is rooted in practical actions. These fall under five central targets:

- **Target 1 – Fisheries and ecosystems: healthy seas and productive fisheries.** The overexploitation of scientifically assessed resources in the Mediterranean and the Black Sea and threats to the biodiversity of these two semi-enclosed basins remain a challenge. Target 1 tackles the sustainability of fisheries from a broad perspective, integrating social, economic and environmental principles, with the objective of reaching exploitation at maximum sustainable yield while addressing the conservation of biodiversity.
- **Target 2 – Compliance and enforcement: a level playing field to eradicate illegal, unreported and unregulated fishing.** In pursuing the implementation of the Regional Plan of Action to Fight Against Illegal, Unreported and Unregulated Fishing (RPOA-IUU), Target 2 aims to end illegal, unreported and unregulated fishing by strengthening compliance and enforcement as well as progressing in the field of monitoring, control and surveillance in a coordinated and transparent way.
- **Target 3 – Aquaculture: a sustainable and resilient sector growing to its full potential.** Target 3 ensures the sustainable development of aquaculture and its contribution to sustainable food systems, working towards the resilience of the sector against global challenges such as climate change and pollution.
- **Target 4 – Livelihoods: decent employment and engaged fishers towards profitable fisheries.** Recognizing the importance of promoting resilient fisheries-based livelihoods while fully and efficiently implementing the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF), Target 4 aims to address, in an integrated way, issues such as employment, socioeconomic knowledge, value chains and participatory decision-making.
- **Target 5 – Capacity development: technical cooperation, knowledge sharing and efficient partnerships in a subregional perspective.** Building capacity and providing technical support at the national and subregional levels ensure that policy commitments made by the GFCM Membership are met. Target 5 builds upon past technical assistance achievements and successful cooperation mechanisms, capitalizing on the implementation of the subregional approach to fisheries management, as well as on the experience of ad hoc GFCM technical assistance projects. Broad and inclusive partnerships underpin the overarching principle of solidarity.

Other important themes cut across the GFCM 2030 Strategy targets and are embedded in its core principles. The role of women and young people in fisheries and aquaculture is one example: the GFCM 2030 Strategy contains a series of measures to promote equal opportunities for women across the board and to substantially increase vocational youth training to support the fishing communities of the future. Furthermore, the GFCM 2030 Strategy recognizes the unique and irreplaceable social, economic and cultural role played by small-scale fisheries in the region and accelerates efforts, across all targets, to strengthen their overall resilience and increase their long-term sustainability.

[1] **FAO.** 2021. GFCM 2030 *Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea*. Rome. https://doi.org/10.4060/cb7562en

Box 2. The GFCM Data Collection Reference Framework

The GFCM Data Collection Reference Framework (DCRF)[1] is the instrument governing the collection and submission of fisheries-related data in the GFCM area of application by GFCM contracting parties and cooperating non-contracting parties (CPCs), in line with binding recommendations adopted by the GFCM. As such, it aims to better integrate data and management measures, underpinning the formulation of sound scientific advice by relevant GFCM subsidiary bodies (namely the Scientific Advisory Committee on Fisheries and the Working Group on the Black Sea), which in turn informs the activities of the GFCM Compliance Committee and ultimately supports GFCM decision-making processes.

The DCRF covers, in a standardized and optimized way, the following national data required by the GFCM:

- global figures on national fisheries;
- catch data (landing data; catch data per species; data on fishing activities, landing points and designated ports in the context of GFCM management plans);
- incidental catch data of vulnerable species;
- fishing fleet data (including on authorized vessels in the context of GFCM management plans);
- fishing effort data (data on fleet segments, fishing gear and catch per unit effort);
- socioeconomic data (economic and social data; operating costs; species value); and
- biological information (stock assessment input data; length data; size at first maturity; maturity data; ecosystem indicators).

The DCRF is a flexible tool, regularly reviewed in light of emerging GFCM requirements, including newly adopted recommendations. It provides CPCs with guidance and references for data to be collected (DCRF manual) and online tools for data entry and official submission (DCRF online platform).

[1] **GFCM.** 2018. Data Collection Reference Framework (DCRF). Version: 22.2. In: *General Fisheries Commission for the Mediterranean*. Rome. Cited 8 November 2022. http://www.fao.org/gfcm/data/dcrf

Executive summary

The State of Mediterranean and Black Sea Fisheries 2022 is the fourth edition of the biennial report prepared by the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO), providing an up-to-date overview of fisheries status, trends and governance in the region. This report describes the current composition of the fishing fleet (Chapter 1), the overall capture fisheries production (Chapter 2), the economic performance and socioeconomic characteristics of capture fisheries (Chapter 3) and bycatch (Chapter 4) and analyses the status of fishery resources (Chapter 5). It also provides insights on small-scale fisheries (Chapter 6) and focuses on the fisheries management measures put in place by the GFCM to support the sustainability of fisheries and the conservation of the marine environment and ecosystems (Chapter 7).

Data and information are presented mostly up to 2020, although when possible, 2021 information is also included. The information contained in this report is based on data officially submitted by GFCM contracting parties and cooperating non-contracting parties (CPCs) in line with binding decisions through a number of established data submission tools or on estimates based on the best available data obtained from other sources or through standard methodologies. Thanks to the consolidation of quality standards over the last two years, *The State of Mediterranean and Black Sea Fisheries 2022* analyses trends in the fisheries sector at the regional level for the first time.

This report unveils the characteristics of a sector that remains under stress despite some positive trends for key fishery resources.

The Mediterranean and Black Sea fisheries sector in a nutshell

The fisheries sector in the Mediterranean and the Black Sea encompasses a total of 85 300 vessels, generating an annual capture fisheries production of 1 189 200 tonnes (excluding tuna-like species), with an associated revenue of USD 2.9 billion and an estimated half a million jobs along the value chain, including 194 000 jobs directly on board fishing vessels. The sector reached

its maximum productivity in the late 1980s, and since then catches have been declining. Since the last edition in 2020, due in part to the impacts of the COVID-19 pandemic, the sector has shown losses of around 15 percent in capture production, 19 percent in revenue and 14 percent in jobs.

Over the entire region, the most productive fleet segment is purse seiners and pelagic trawlers (48 percent of total landings in the Mediterranean Sea, 68 percent in the Black Sea), while the most valuable fleet segments in terms of physical capital are trawlers and beam trawlers in the western Mediterranean (64.3 percent of the entire value of the subregional fleet), purse seiners and pelagic trawlers in the Black Sea (55 percent of the entire value of the subregional fleet) and small-scale vessels in the eastern Mediterranean (40 percent of the entire value of the subregional fleet).

Status of Mediterranean and Black Sea commercial marine living resources and vulnerable species groups

Most commercial stocks (73 percent) are fished outside biologically sustainable limits, and fishing pressure is still twice the level considered sustainable (F/F_{MSY} = 2.25). However, fishing pressure in the Mediterranean and the Black Sea has decreased on average by 21 percent over the last decade and, for certain priority species subject to management measures, by as much as 75 percent. The effects of this reduction are starting to show in the increased biomass of some stocks, but it is not sufficient yet to produce a significant region-wide increase in fish biomass for stocks that are considered below ideal biomass levels.

Vulnerable species are affected by different anthropogenic stressors, including climate change, plastic pollution, habitat degradation and negative interactions with fisheries. In the Mediterranean, the main groups of vulnerable species affected by fisheries are sea turtles and elasmobranchs, both subject to incidental catch mostly by longliners and bottom trawlers, while in the Black Sea, the main group affected is dolphins, which are incidentally captured mainly by coastal fisheries (i.e. gillnet and trammel net) targeting Black Sea turbot (*Scophthalmus maximus*).

The human dimension behind Mediterranean and Black Sea fisheries

Fisheries are an important source of coastal livelihoods, employing on average 1 in every 1 000 coastal residents in the Mediterranean and Black Sea region as a fisher (in some countries, this number can reach as high as 1 in every 100 coastal residents). In the region, 59 percent of the total employment on board fishing vessels comes from small-scale fisheries (SSF). However, the onboard workforce is ageing: in 2020, 52 percent of all crew were over the age of 40 (compared to 49 percent in 2018), while only 10 percent were under the age of 25 (compared to 17 percent in 2018).

Despite their importance at the regional level, SSF generate a low profit margin (17 percent of total annual revenue, compared to 27 percent for the industrial fleet). Since the adoption of the Regional Plan of Action for Small Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF), countries have increased their support to this sector, with a recent added emphasis on mitigating the impacts of the COVID-19 pandemic. Currently, half of GFCM countries provide minimum social security benefits (health coverage and retirement pension) to all fishers in this sector, while only one third guarantee unemployment insurance for all fish workers.

Building a sustainable future for Mediterranean and Black Sea fisheries: measures taken and challenges remaining

In line with its mandate, and particularly with the objectives set out in the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (GFCM 2030 Strategy), the GFCM is consolidating a regional regulatory framework based on the implementation of management plans for key fisheries, fisheries restricted areas (FRAs) and measures to minimize the incidental catch of vulnerable species and maximize the productivity of commercial marine living resources.

Over the last decade, especially in the last five years, a significant number of management plans and dedicated spatial and technical management measures have been implemented, extended and upgraded. Since 2020, management measures for one key stock have been upgraded to a full management plan, five existing plans were revised, four recommendations outlining new management measures or updating existing

ones, as well as four recommendations towards the conservation of vulnerable species, were adopted. Currently, the GFCM has in place ten active multiannual fisheries management plans targeting a number of priority stocks and involving nearly 7 000 active vessels, a number of other technical measures for select fisheries as well as ten FRAs that improve the exploitation patterns and conservation of specific stocks and deep-sea ecosystems across more than 1.7 million square kilometres of the Mediterranean and the Black Sea.

MAIN FINDINGS BY CHAPTER

The Mediterranean and Black Sea fleet is dominated by small-scale vessels – followed by demersal trawlers, purse seiners and pelagic trawlers – and has remained stable over the last two years, with a minor reduction in overall numbers.

The Mediterranean and Black Sea operating fleet is comprised of 85 200 vessels, with a total gross tonnage of 841 000. These figures have decreased by 3 percent and 7 percent, respectively, since 2020. Around 74 200 vessels (87 percent) operate in the Mediterranean Sea, and 11 000 (13 percent) operate in the Black Sea. Of the total fleet, 82 percent (68 800 vessels) are small-scale vessels. Some 7 000 demersal trawlers make up the next largest fleet segment (8 percent), followed by 4 300 purse seiners and pelagic trawlers (5 percent). Nearly 7 000 of these vessels operate within the context of ten GFCM fisheries management plans, principally in Adriatic Sea demersal fisheries (1 946 vessels) and in the Black Sea turbot fishery (1 818 vessels). Four countries contribute 59 percent of the total fishing fleet by number of vessels. Türkiye represents the largest share, followed by Tunisia, Greece and Italy. Türkiye, Italy, Tunisia, Algeria and Egypt make up 64 percent of the total fishing capacity.

Capture fisheries production in the region has been stalled since the mid-1990s, with a decrease in 2020 likely exacerbated by the impacts of the COVID-19 pandemic. Purse seiners and pelagic trawlers targeting mainly sardine and anchovy dominate production, followed by trawlers and small-scale vessels fishing a variety of mainly demersal species.

Landings for the Mediterranean and the Black Sea (2018–2020 average) amount to 1 189 200 tonnes (excluding tuna-like species), very similar to the landings reported in *The State of Mediterranean and Black Sea Fisheries 2020* (2016–2018 average). However, landings in 2020 show a 16 percent decline in comparison with 2019, likely related to some extent to the impacts of the COVID-19 pandemic on fleet dynamics, demand and trade. The total production for the Mediterranean Sea in 2020 was 743 100 tonnes (62 percent of the total capture fisheries production in the region). Morocco has seen the largest increase since 2018 (+1 700 tonnes) while Italy's catch has decreased the most (-22 900 tonnes). In the Black Sea, total production was 446 100 tonnes (37 percent of the total capture fisheries production in the region). Türkiye's catch has increased the most since 2019 (+52 300 tonnes), while Romania has shown the largest decrease (-1 600 tonnes). Türkiye is still by far the largest regional producer, followed by Italy, Tunisia, Algeria and Georgia. When it comes to production shares by fleet segment, purse seiners and pelagic trawlers landed 54 percent of the total regional catch, followed by trawlers (21 percent) and small-scale vessels (15 percent).

Despite a decrease in revenue and number of jobs, the Mediterranean and Black Sea capture fisheries sector makes a significant contribution to food production, the regional economy and livelihoods. However, the workforce is ageing, highlighting the need for a generational turnover.

Total fisheries revenue in 2020 was USD 2.9 billion. The Mediterranean contributed USD 2.7 billion to this total and the Black Sea USD 241 million. The three most important commercial species, in terms of value, in the Mediterranean were European anchovy (*Engraulis encrasicolus)* at USD 200 645 882, sardine (*Sardina pilchardus*) at USD 187 606 195 and European hake (*Merluccius merluccius*) at USD 177 053 732.

European anchovy also brought in the most revenue in the Black Sea (USD 98 870 766), followed by Atlantic bonito (*Sarda sarda*) at USD 42 266 935 and bluefish (*Pomatomus saltatrix*) at USD 17 781 855. The wider economic contribution of fisheries in the region is estimated to be 2.6 times the value at first sale, or USD 7.7 billion. Capture fisheries job numbers have fallen since 2020. Direct onboard jobs stand at 194 000, representing a decrease of 14 percent over the last two years, with around half a million people employed along the entire value chain. Small-scale fisheries are responsible for 59 percent of total onboard employment and employ the highest number of young people. However, the average remuneration of an individual small-scale fisher (USD 4 021) is less than half the average in industrial fleet segments (USD 8 366). Despite the continuing importance of the capture fisheries sector to Mediterranean and Black Sea society, the workforce is ageing: in 2020, 52 percent of all crew were over the age of 40 (49 percent in 2018) and only 10 percent were under 25 (17 percent in 2018).

Mediterranean trawl fisheries have a significant discard ratio, while the rest of the fleet shows much smaller values. Vulnerable species are affected by different anthropogenic stressors, including climate change, plastic pollution, habitat degradation and negative interactions with fisheries. The main groups of vulnerable species incidentally caught by fisheries are marine turtles and elasmobranchs, while incidental catches of cetaceans and seabirds are rarer, with the exception of cetaceans in the Black Sea.

Discard ratios vary widely depending on the fishing method and geographical area. Trawlers show by far the highest discard ratios, ranging from 34 to 44 percent across the region. All other types of gear show much lower ratios, from small pelagic purse seines (< 6 percent) to demersal longlines (6–7 percent) and pelagic longlines (< 1 percent). Discard ratios in small-scale fisheries range from 3 to15 percent. When it comes to vulnerable species, longliners and bottom trawlers are the two fleet segments with the most recorded occurrences of incidental capture (accumulated from all information available across all years) and are together responsible for about 80 percent of the reported individuals incidentally caught, which belong to the following groups of vulnerable species: sea turtles (89 percent of the records), elasmobranchs (8 percent of the records), cetaceans (2 percent of the records) and seabirds (1 percent of the records).

The overexploitation of stocks has decreased over the past decade, with an accelerated reduction of fishing pressure in the last two years, particularly for key species under management plans. However, most commercial species are still overexploited, and fishing pressure is still double what is considered sustainable.

Most stocks for which validated assessments are available continue to be fished outside biologically sustainable limits, and average fishing pressure is still twice the level considered sustainable (average F/F_{MSY} = 2.25). Nevertheless, there has been a 10 percent decrease in the percentage of stocks in overexploitation since 2012 and a continuous gradual decrease in fishing pressure since 2012 (a 21 percent decrease since 2012, double what was reported in 2020). For some priority species under management plans, fishing pressure has declined by considerably more over the past decade, including European hake (-39 percent), turbot (-62 percent) and common sole (*Solea solea*) (-75 percent). However, fishing pressure continues to increase on certain other stocks, notably commercially important blue and red shrimp (*Aristeus antennatus*) in the central and eastern Mediterranean. While the biomass of some species under management plans is already increasing as a result of decreased fishing pressure, others have yet to show improvement. Across the region, 44 percent of stocks were found to have low relative biomass levels, with 19 percent intermediate and 37 percent high.

Small-scale fisheries provide more than half the total number of onboard jobs with only a small percentage of the total catch. Countries have advanced in providing this sector with minimum social protection, but advances in other areas of the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea are needed.

Small-scale fisheries make up 82 percent of the total fleet, provide 59 percent of total onboard employment, raise 27 percent of total revenue and bring in 15 percent of the total catch. These figures are similar to those reported in 2020, but they are grounded in more detailed information. Historically, SSF have been underrepresented in data collection exercises: redressing the balance is one of the central aims of the RPOA-SSF, and improvements in data quality are already evident. The RPOA-SSF has also recently led to important advances in other areas of particular significance for small-scale fishers. These include establishing co-management approaches, identifying priority species for research and management, securing access to resources by increasing the numbers of SSF landing sites, improving access to and coverage by social protection programmes and supporting capacity building for small-scale fishers. *The State of Mediterranean and Black Sea Fisheries 2022* also reports more modest advances in other RPOA-SSF areas, such as increases in the numbers of CPCs reporting landing information and in the numbers of CPCs collecting gender disaggregated data, engaging small-scale fishers in local participatory decision-making and in local monitoring, control and surveillance activities, improvements in the representation of women in leadership positions and addressing the impacts of climate change. Social protection for the SSF sector varies considerably between CPCs but is in general gradually improving. More than half of CPCs provide small-scale fishers with access to health coverage and old age pensions, but only 37 percent offer all fishers access to unemployment insurance.

A regional governance framework based on management plans and spatial and technical measures is providing tangible results in reducing unsustainable fishing pressure for key species. However, this framework needs to be extended to all commercial fisheries, and implementation and enforcement need to be quickly strengthened to achieve the objectives of the GFCM 2030 Strategy.

Since 2020, management measures for one key stock have been upgraded to a full management plan, five existing plans have been revised, four management recommendations and four recommendations on vulnerable species have been adopted, and the first GFCM research programme (on European eel [*Anguilla anguilla*]) has been completed. Management measures do take time to take effect, however. Nevertheless, some positive results are already visible from the GFCM's ten active management plans, and additional technical management measures, particularly for Black Sea turbot, European hake, and Adriatic Sea demersal resources. Spatial management has also seen important advances. Fisheries restricted areas are a key area of focus, with one new FRA created, two previously existing FRAs updated, and a resolution to identify new FRAs in the southern Adriatic Sea adopted. Fisheries restricted area monitoring plans are progressing closer to establishment. Finally, the GFCM's analytical and dynamic database of sensitive benthic habitats and species has been significantly expanded and now contains more than 20 000 records – it is a vital primary source of information for formulating scientific advice on priority areas for spatial management.

©GFCM/Claudia Amico

PART 1

Status and trends of Mediterranean and Black Sea fisheries

©GFCM/Ainhoa Goma

1. Status of the fishing fleet

This chapter encompasses the most up-to-date information on the fishing fleet operating in the GFCM area of application. Analyses take into consideration key aspects of fishing vessels in the Mediterranean Sea (geographical subareas [GSAs] 1 to 27), the Marmara Sea and the 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, management measures and fisheries restricted areas (FRAs), in which fishing activity is regulated by different types of restrictions and temporal limitations.

The data and information 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 the establishment of a GFCM record of vessels over 15 metres authorized to operate in the GFCM area of

application, amending Recommendation GFCM/29/2005/2.[1] The data, as transmitted by CPCs, are stored in the GFCM vessel record 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, 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 (DCRF); and GFCM/41/2017/6 on the submission of data on fishing activities in the GFCM area of application. The first recommendation was in force for eight years until 2017; the second was transitory and thus valid in 2017 only; the third became binding in 2018[2] for all CPCs. These decisions requested various types of information on the operations of national fishing fleets in the GFCM area of application, including the number and capacity of vessels, catch, fishing effort and socioeconomic and biological variables of the fleets. The accurate picture that these data provide of the fishing fleets operating in the area is at the aggregated level of GFCM fleet segments, which are based on the size of vessels, propulsion and dominant fishing gear (Box 6).
- 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 Recommendations 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 exploiting 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 (see Chapter 7 for a summary of fisheries management decisions).

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

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

[2] Recommendation GFCM/41/2017/6 is the result of the progressive implementation of the DCRF, and it repealed Recommendation GFCM/33/2009/3.

FISHING FLEET

The fishing fleets in operation in the Mediterranean (GSAs 1 to 27), the Marmara Sea and the Black Sea (GSAs 28 and 29) consist of around 85 200 operating fishing vessels, with a gross tonnage (GT) of around 841 000 and a total engine power of 5 390 000 kilowatts (kW) (Table 4). Despite the presence of some gaps, data quality and coverage have generally improved over the last two years due to greater and more consistent data submissions from CPCs to the GFCM, in particular additional information on the International Maritime Organization (IMO) number (Box 3) and more robust data on the age of the fleets. The current reported number of operating fishing vessels is 2.7 percent lower (around 1 200 units fewer) than reported in 2020 (FAO, 2020a). The four largest fleets (i.e. each over 10 000 vessels), belonging to Türkiye, Tunisia, Greece and Italy,

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

CPCs, non-contracting parties and relevant non-state actors	Operating fishing vessels		Capacity (GT)	Engine power (kW)	Reference year
	Number	Percentage of the total (%)			
Albania*	480	0.56	11 356	84 444	2021
Algeria*	5 974	7.01	76 414	694 026	2021
Bulgaria*	1 182	1.39	4 699	38 274	2021
Croatia*	6 235	7.31	32 148	253 520	2021
Cyprus*	787	0.92	3 615	37 576	2021
Egypt*	3 611	4.24	74 454	296 386	2020
France*	1 423	1.67	15 707	146 846	2021
Georgia*	49	0.06	9 184	43 264	2019
Greece*	12 266	14.39	62 561	361 175	2021
Israel*	366	0.43	1 965	24 868	2021
Italy*	10 311	12.09	126 722	809 847	2021
Lebanon*	1 675	1.96	1 274	67 154	2021
Libya**	3 708	4.35	55 431	296 456	2021
Malta*	624	0.73	4 800	52 243	2021
Montenegro*	191	0.22	697	8 827	2021
Morocco*	3 238	3.80	20 626	113 640	2021
Palestine*	1 057	1.24	1 868	24 191	2021
Portugal*	1	0.00	224	456	2021
Romania*	130	0.15	1 352	5 332	2021
Slovenia*	72	0.08	342	5 074	2021
Spain*	2 015	2.36	49 530	190 783	2021
Syrian Arab Republic*	1 300	1.52	23 400	26 000	2019
Tunisia*	13 081	15.34	103 112***	533 721	2020
Türkiye*	14 815	17.38	158 688	1 248 131	2021
Ukraine*	661	0.78	990	28 550	2020
Total	**85 252**	**100**	**841 485**	**5 394 403**	

Notes: Bosnia and Herzegovina and Monaco are not included in the table. These countries reported to the GFCM Secretariat that they had no operating fishing fleet at the time this publication was being prepared. Additionally, the Russian Federation provided no data to the GFCM Secretariat on its fishing fleet as relating to the GFCM area of application.

Sources of data:

* **GFCM.** 2018. Data Collection Reference Framework (DCRF). Version: 22.2. In: *General Fisheries Commission for the Mediterranean – GFCM.* Rome. Cited 8 November 2022. fao.org/gfcm/data/dcrf

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

*** Capacity data for the Tunisian fishing fleet are available for fishing vessels above 5 tonnes (GT) only.

Box 3. International Maritime Organization number

The International Maritime Organization (IMO) number, assigned under the IMO ship identification number scheme,[1] is an established and reliable unique vessel identifier that facilitates the unequivocal identification of a vessel and is particularly useful for fighting illegal, unreported and unregulated fishing.

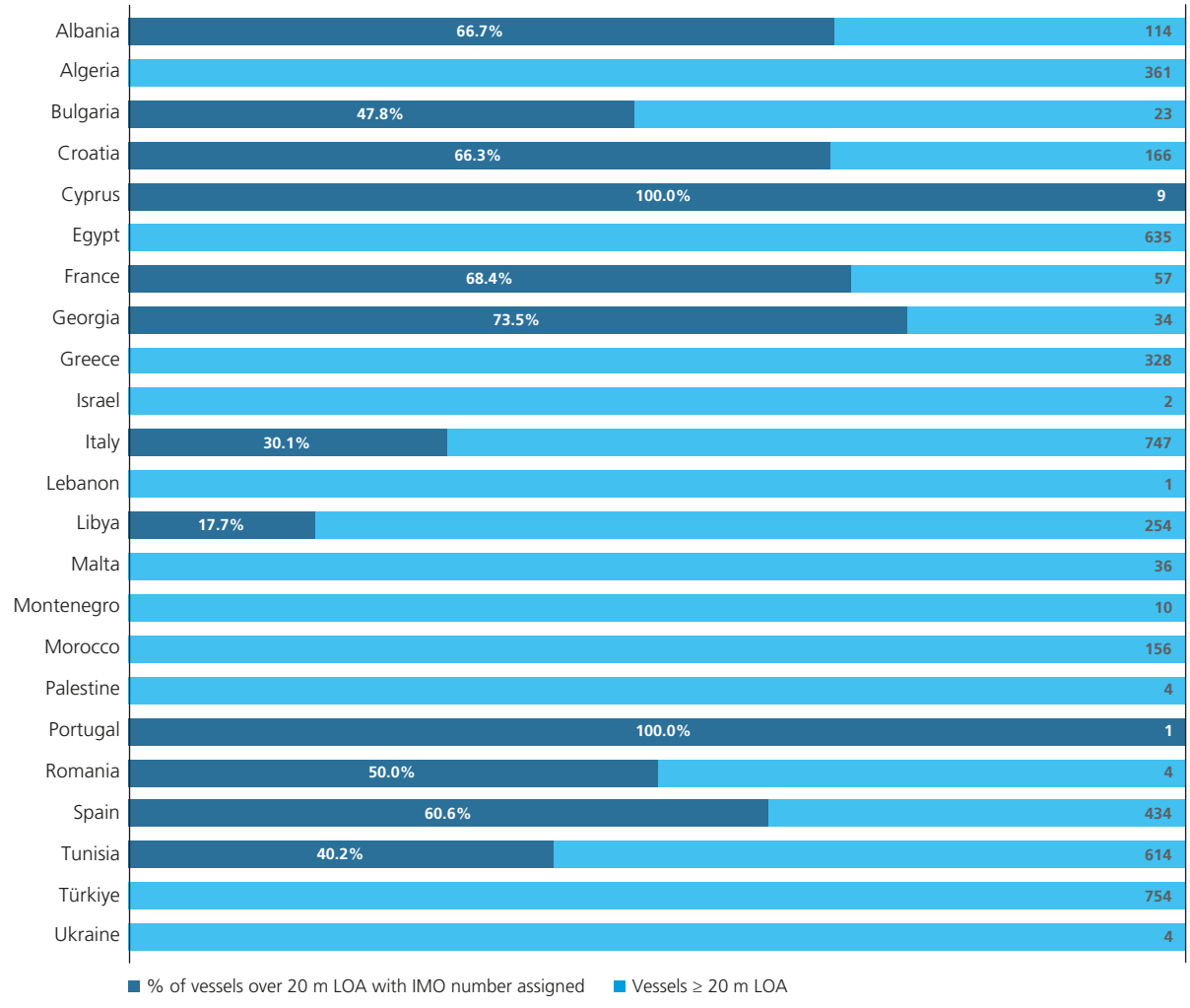
Resolution GFCM/44/2021/6 on the application of an International Maritime Organization number, amending Resolution GFCM/41/2017/6, defines two new criteria for the assignment of the IMO number:

- fishing vessels of steel and non-steel hull construction with a length overall (LOA) of 20 m or above; and
- fishing vessels operating in international waters.

Considering that the GFCM Secretariat has fragmented information regarding vessels' operating waters, only the first criterion is taken into account in showing the breakdown by country of GFCM authorized vessels that meet the requirements in terms of LOA for the assignement of an IMO number (4 748 vessels) and the percentage of vessels with an IMO number already assigned (22.2 percent of the total fleet over 20 m LOA).

[1] The IMO ship identification number scheme established by IMO Resolution A.600(15) was subsequently amended by IMO Resolution A.1078(28) and Resolution A.1117(30).

Percentage of vessels over 20 m LOA with an IMO number assigned



Notes: Bosnia and Herzegovina and Monaco are not included in the table. These countries reported to the GFCM Secretariat that they had no operating fishing fleet at the time this publication was being prepared. Additionally, the Russian Federation and the Syrian Arab Republic provided no data to the GFCM Secretariat on their fishing fleets as relating to the GFCM area of application.

show a combined reduction of about 3.6 percent, dropping by 1 895 vessels in total, while among the smaller fleets (i.e. under 500 vessels), belonging to Romania, Montenegro, Israel and Albania, there is a combined drop of 24 vessels in the total figure. In relation to fishing fleets between 1 000 and 2 000 vessels, special attention should be paid to the information from Palestine and Lebanon: compared to the fishing fleet figures reported in the *State of Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a), more reliable data provided have shown an increase of 72.4 percent and a decrease of 19.6 percent, respectively, in the number of operating vessels. Some gaps and lack of data on certain parts of the fishing fleet, especially on small-scale vessels, from some Mediterranean and Black Sea coastal states or non-state actors may likely result in an underestimate of the real size of the fleet.

Almost 60 percent of the total reported number of operating fishing vessels is represented by just four countries: Türkiye (17.4 percent), Tunisia (15.3 percent), Greece (14.4 percent) and Italy (12.1 percent, Table 4). The breakdown by area reveals that, together, Tunisia, Greece and Italy account for around 48 percent of operating fishing vessels in the Mediterranean Sea, while Türkiye represents 81.6 percent of the total fleet in the Black Sea (Table 7). See Box 4 for detailed information on fleets operating in the context of GFCM priority fisheries and Box 5 for fleets authorized to fish in FRAs.

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 841 000 GT and 5 390 000 kW, as shown in Figure 2, i.e. slightly lower than in *The State of Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a), with a reduction of 6.9 percent and 6.2 percent, respectively. Compared to the fishing capacity figures reported in the previous report, Albania shows an important increase in capacity (GT) of 65.1 percent due to an in-depth analysis carried out by the Albanian authorities on capacity data (in GT) for recent years. It is important to underline that five countries alone account for around 64.1 percent of the total fishing capacity (in GT) in the GFCM area of application: Türkiye (18.9 percent), Italy (15.1 percent), Tunisia (12.3 percent),[3] Algeria (9.1 percent) and Egypt (8.9 percent). 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

[3] Capacity data for the Tunisian fishing fleet are available for fishing vessels above 5 tonnes (GT) only.

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

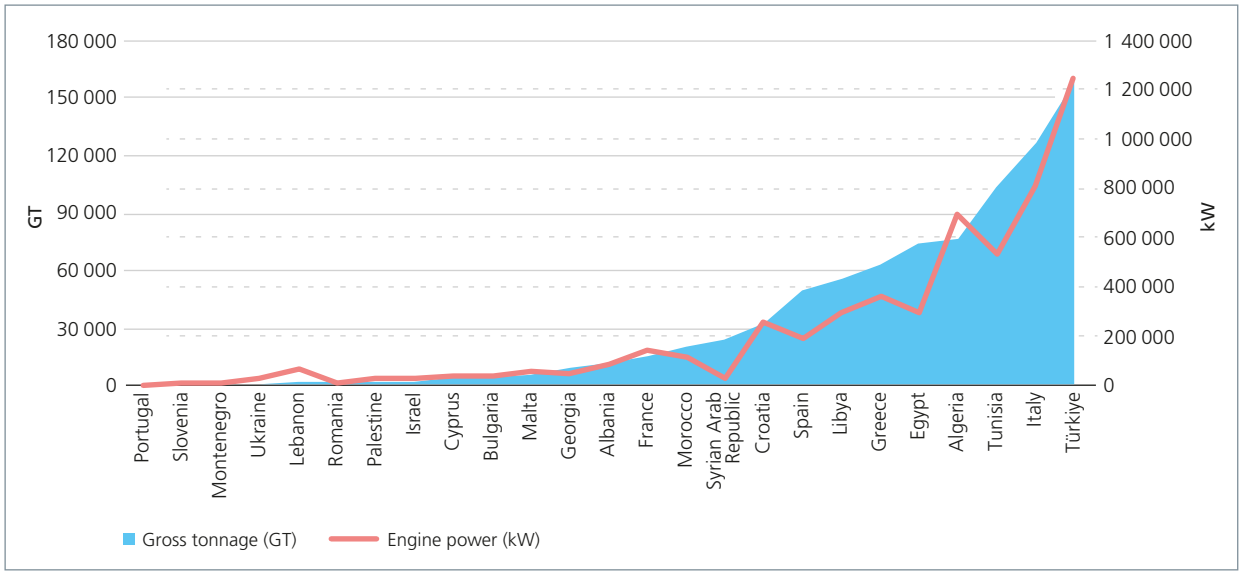
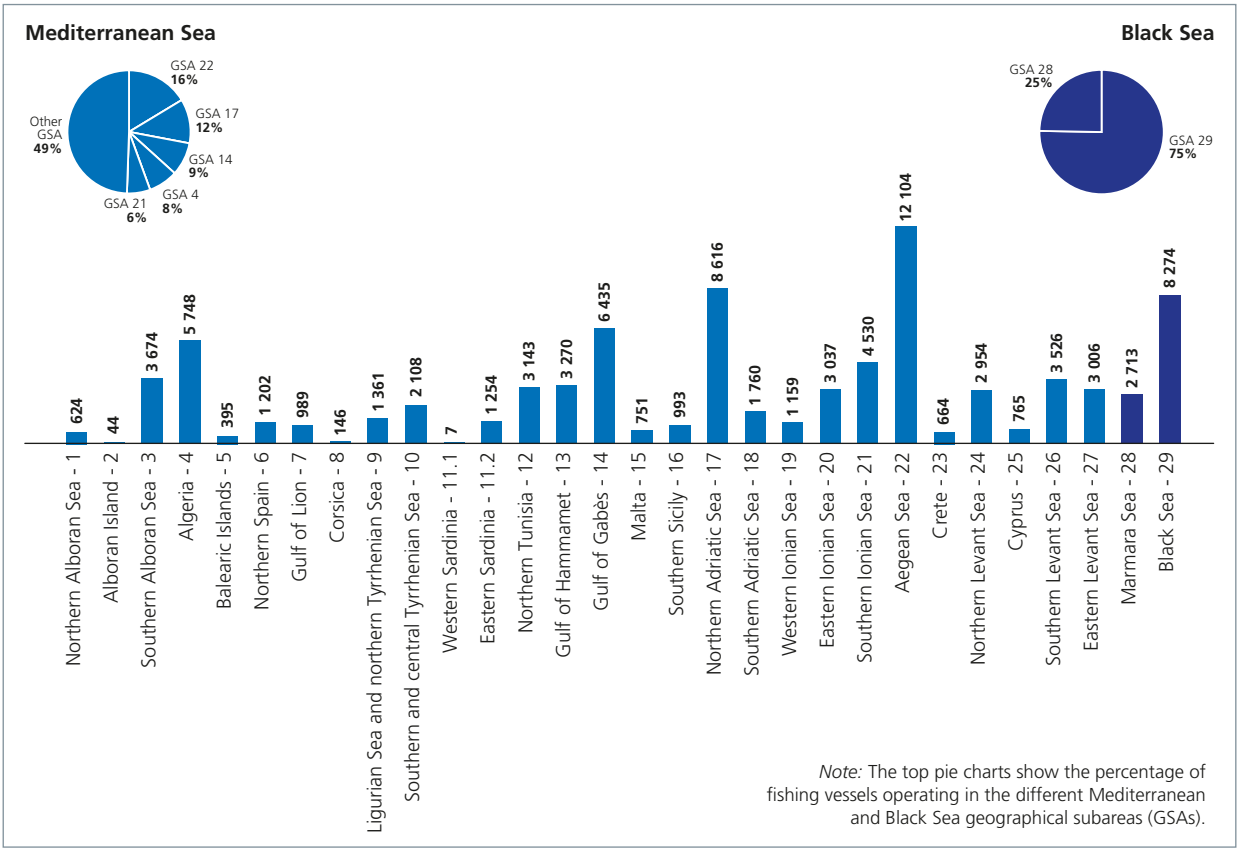


FIGURE 3. Number of operating fishing vessels by geographical subarea



Note: The top pie charts show the percentage of fishing vessels operating in the different Mediterranean and Black Sea geographical subareas (GSAs).

as reported by countries to the GFCM through "DCRF Task II.1 Landing data" (operating fishing vessels and landings by fleet segment and GSA), which were then extrapolated to estimate 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 50 percent of all the operating fishing vessels: GSA 22 (Aegean Sea, 16.2 percent); GSA 17 (northern Adriatic Sea, 11.5 percent); GSA 14 (Gulf of Gabès, 8.6 percent); GSA 4 (Algeria, 7.7 percent); and GSA 21 (southern Ionian Sea, 6.1 percent). Only GSA 22 (Aegean Sea) shows a significant decrease (10.4 percent) compared to the data reported in the previous edition (FAO, 2020a).

Despite the operating fishing fleet in the Marmara Sea and Black Sea area (GSAs 28 and 29) showing an overall decline of 3.3 percent compared to the previous edition (FAO, 2020a), its local distribution has changed considerably in the last two years, dropping by 10.3 percent in the Black Sea (GSA 29) to around 8 300 operating fishing vessels (i.e. a loss of more than 900 vessels) and increasing in the Marmara Sea (GSA 28) by 27.3 percent to around 2 700 operating fishing vessels (i.e. a gain of around 580 vessels).

The largest shares of operating vessels are from the central and eastern Mediterranean subregions, accounting for 27.4 and 27 percent of the total respectively, whereas the Marmara Sea and Black Sea area accounts for 12.9 percent (Figure 4).

AGE OF THE FISHING FLEET

The average year of construction 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 73 percent of a country's total fleet, i.e. higher than the previous edition's average coverage of around 71 percent; FAO, 2020a), the availability has improved for several countries, mainly Libya, Tunisia, Türkiye and Ukraine.

FIGURE 4. Percentage of all fishing vessels operating in the Mediterranean and the Black Sea represented by each GFCM subregion

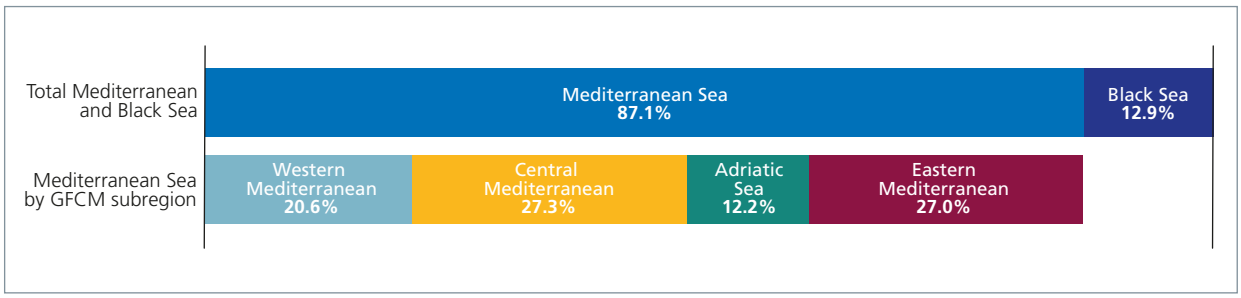


TABLE 5. Average year of construction and age of fishing vessels in the GFCM vessel record

CPCs, non-contracting parties and relevant non-state actors	Fishing vessels – average		95% confidence interval	Data coverage (%)
	Year of construction	Age		
Albania	1983	39	14–67	68.0
Algeria	N/A	–	–	–
Bulgaria	1997	25	5–42	100.0
Croatia	1981	41	–	99.6
Cyprus	1992	30	13–47	90.2
Egypt	2005	17	4–33	63.0
France	1986	36	8–59	100.0
Georgia	1994	28	4–53	100.0
Greece	1989	33	10–58	100.0
Israel	1973	49	26–71	3.9
Italy	1985	37	8–65	100.0
Lebanon	N/A	–	–	–
Libya	1998	24	9–47	8.2
Malta	1990	32	9–61	99.8
Montenegro	1989	33	2–60	100.0
Morocco	2006	16	6–35	100.0
Palestine	1996	26	21–21	100.0
Portugal	2000	22	21–21	100.0
Romania	2004	18	4–47	95.5
Slovenia	1979	43	17–69	100.0
Spain	1987	35	13–78	100.0
Syrian Arab Republic	N/A	–	–	–
Tunisia	1993	29	7–54	24.3
Türkiye	2001	21	1–41	64.5
Ukraine	1995	27	3–47	89.9
Average	**1992**	**30**		**73.0**

Notes:
Bosnia and Herzegovina and Monaco are not included in the table. These countries reported to the GFCM Secretariat that they had no operating fishing fleet at the time this publication was being prepared. Additionally, the Russian Federation provided no data to the GFCM Secretariat on its fishing fleet as relating to the GFCM area of application.

Data coverage (%) = percentage of data records with information on the fishing vessel's year of construction.

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

Box 4. Fishing vessels authorized to operate in GFCM priority fisheries

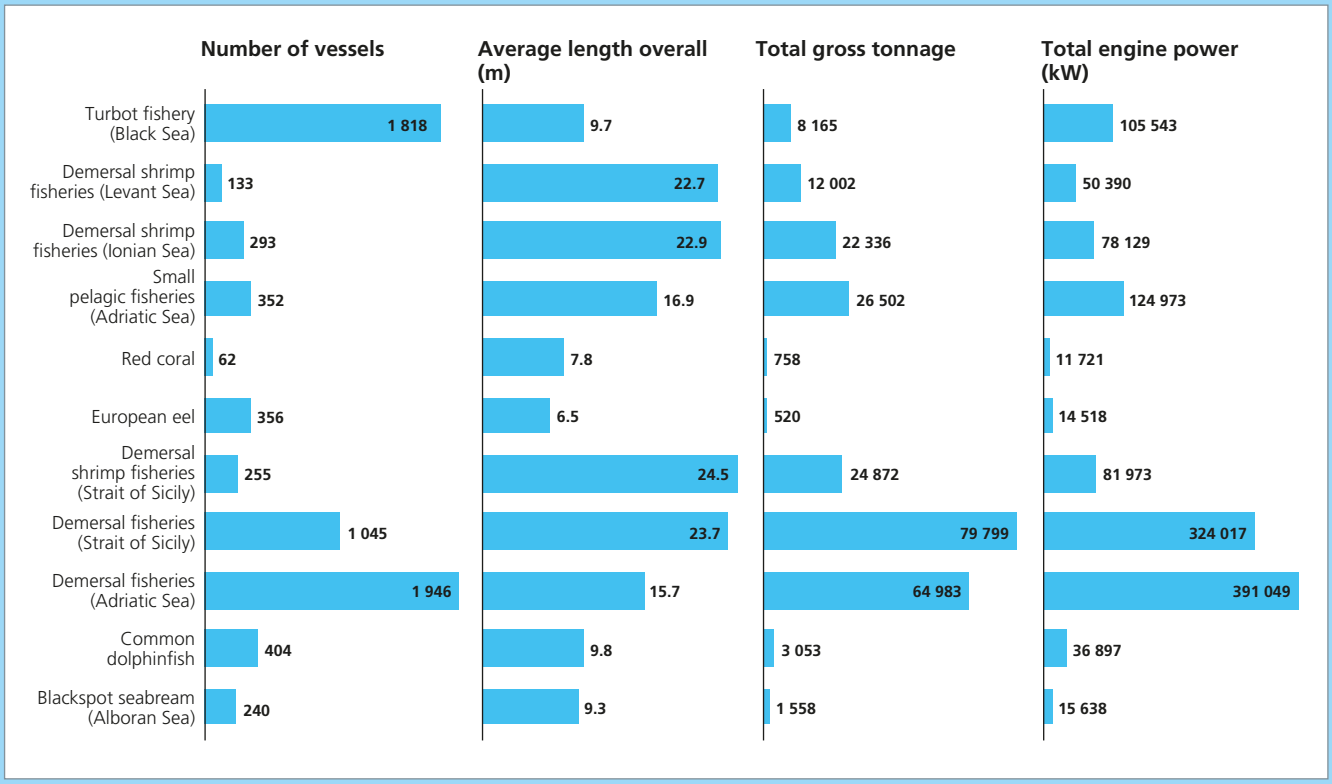
In accordance with relevant GFCM recommendations related to the management of fisheries at the subregional level (see Chapter 7), the GFCM gathers information on fishing vessels authorized to operate in geographically defined areas and targeting specific species. The following notes provide the most up-to-date information on fishing vessels reported to the GFCM (fisheries are listed in alphabetical order, while countries that submitted a list of authorized vessels are included in brackets):[1]

Blackspot seabream (*Pagellus bogaraveo*) fishery in the Alboran Sea – geographical subareas (GSAs) 1 to 3 (Morocco and Spain)
240 vessels (around 1 500 gross tonnage [GT]) are operating in and authorized for the blackspot seabream fishery. Morocco and Spain account for around 75 percent and 25 percent of the total fleet, respectively.

Common dolphinfish (*Coryphaena hippurus*) fisheries using anchored fish aggregating devices (FADs) in the Mediterranean Sea (Italy, Malta and Spain)
404 vessels (around 3 000 GT), mainly purse seiners (42 percent), are authorized on a seasonal basis. In terms of capacity, Italy leads the fleet fishing common dolphinfish with FADs in the Mediterranean Sea (64.4 percent of the total fleet).

[1] No information is yet available on the list of authorized vessels for the sprat or the piked dogfish fisheries in GSA 29.

Information on authorized fishing vessels in GFCM priority fisheries



(Continued)

Box 4. (continued)

Demersal fisheries in the Adriatic Sea – GSAs 17 and 18 (Albania, Croatia, Italy, Montenegro and Slovenia)
1 946 vessels (around 64 900 GT) are operating. Fishing vessels are bottom trawlers authorized for demersal fisheries in the Adriatic Sea, with around 70 percent of the total fleet belonging to Italy.

Demersal fisheries in the Strait of Sicily – GSAs 12 to 16 (Cyprus, Italy, Malta, Spain and Tunisia)
1 045 vessels (around 79 800 GT) are operating. Fishing vessels are bottom trawlers authorized for demersal fisheries in the Strait of Sicily. Italy and Tunisia account for around 57 percent and 41 percent of the total fleet, respectively.

Demersal shrimp fisheries in the Strait of Sicily – GSAs 12 to 16 (Cyprus, Italy, Malta and Spain)
255 vessels are operating (around 24 800 GT). Fishing vessels are trawlers authorized for deep-water shrimp fisheries in the Strait of Sicily. Italy accounts for around 94 percent of the total fleet.

European eel (*Anguilla anguilla*) in the Mediterranean Sea (Croatia, France, Greece and Spain)
356 vessels (around 519 GT) are operating in transitional and brackish waters. France and Spain account for around 62.6 percent and 20.8 percent of the total fleet, respectively.

Red coral (*Corallium rubrum*) in the Mediterranean Sea (Croatia, France, Italy, Tunisia and Spain)
62 vessels (around 755 GT) are operating. Fishing vessels are those authorized to harvest red coral in the Mediterranean Sea. Tunisia and France account for around 48 percent and 17 percent, respectively (i.e. together 66 percent of the total fleet).

Small pelagic fisheries in the Adriatic Sea – GSAs 17 and 18 (Albania, Croatia, Italy, Montenegro and Slovenia)
350 vessels (around 26 400 GT) are operating. Fishing vessels are purse seiners and pelagic trawlers authorized to fish key small pelagic stocks in the Adriatic Sea (GSAs 17 and 18). Croatia and Italy account for around 48 percent and 36 percent of the fleet, respectively (i.e. together 84 percent of the total fleet).

Demersal shrimp fisheries in the Ionian Sea – GSAs 19 to 21 (Greece, Italy and Malta)
293 vessels (around 22 300 GT) are operating. Fishing vessels are bottom trawlers authorized for demersal fisheries targeting giant red shrimp (*Aristaeomorpha foliacea*) and blue and red shrimp (*Aristeus antennatus*) in the Ionian Sea. Italy accounts for around 58 percent of the total fleet.

Demersal shrimp fisheries in the Levant Sea – GSAs 24 to 27 (Cyprus, Israel, Italy and Türkiye)
133 vessels (around 12 000 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. Türkiye and Italy account for around 58 percent and 26 percent, respectively (i.e. together 84 percent of the total fleet).

Turbot (*Scophthalmus maximus*) fishery in the Black Sea – GSA 29 (Bulgaria, Romania, Türkiye and Ukraine)
1 818 vessels (approximately 8 100 GT) are operating. Fishing vessels using bottom-set gillnets are authorized to fish for turbot. Türkiye and Ukraine account for around 64 percent and 25 percent, respectively (i.e. together 89 percent of the total fleet).

The following patterns emerge: Morocco has the youngest fleet, with an average age of 16 years old, followed by Egypt (17 years old), Romania (18 years old) and Türkiye (21 years old). By contrast, the oldest fishing vessels are from Israel (49 years old), Slovenia (43 years old), Croatia (41 years old) and Albania (39 years old). While the age of the fleets in these latter countries may present a matter of concern for safety, replacing ageing vessels can present its own drawbacks. Potential increases in fishing capacity could ensue if no rules are in place to regulate the entry of new vessels into the fishery. Currently, 777 vessels (82 percent of them under 12 m LOA) constructed in 2020 and 2021 have been incorporated into the GFCM fleet, contributing at least 12 250 GT to the total fishing capacity.

Box 5. 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).[1] A 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). The following notes provide the most up-to-date information on fishing vessels reported to the GFCM.

Gulf of Lion – geographical subarea 7 (France and Spain)

The eastern Gulf of Lion FRA was established in 2009 and revised in 2021 to better protect spawning aggregations and deep-sea sensitive habitats.

38 vessels are operating in the eastern Gulf of Lion FRA. The French authorized fleet is slightly larger than the Spanish one (20 French vessels versus 18 Spanish vessels).

Jabuka/Pomo Pit – geographical subarea 17 (Croatia and Italy)

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

112 vessels are currently operating (63 Croatian vessels and 49 Italian vessels) in the area where restricted fishing is allowed.

[1] No information has been reported by the time of this publication for the Bari Canyon FRA (GSA 18).

Information on authorized fishing vessels in the context of existing GFCM fisheries restricted areas

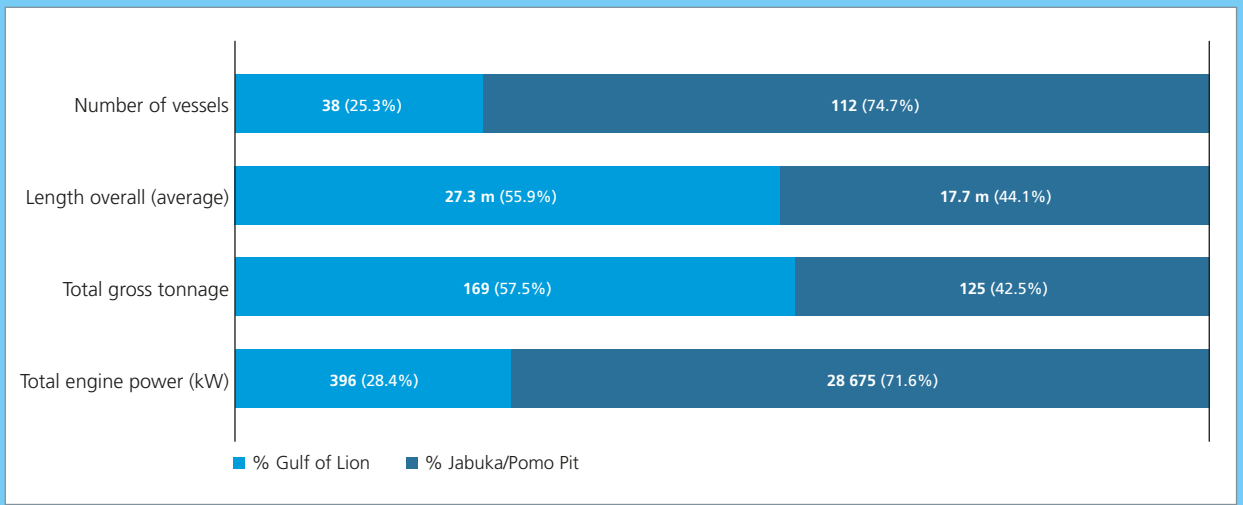
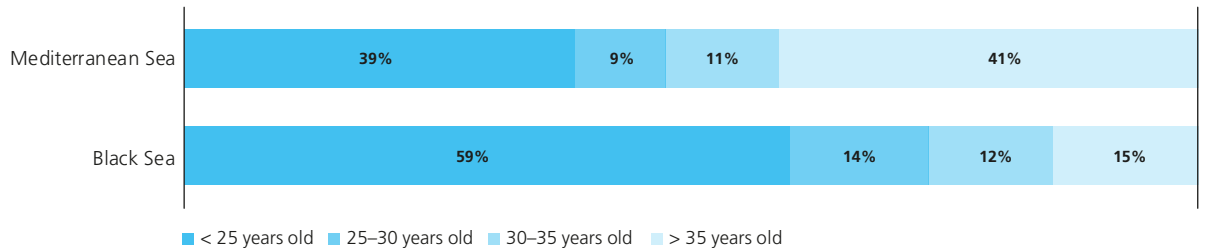
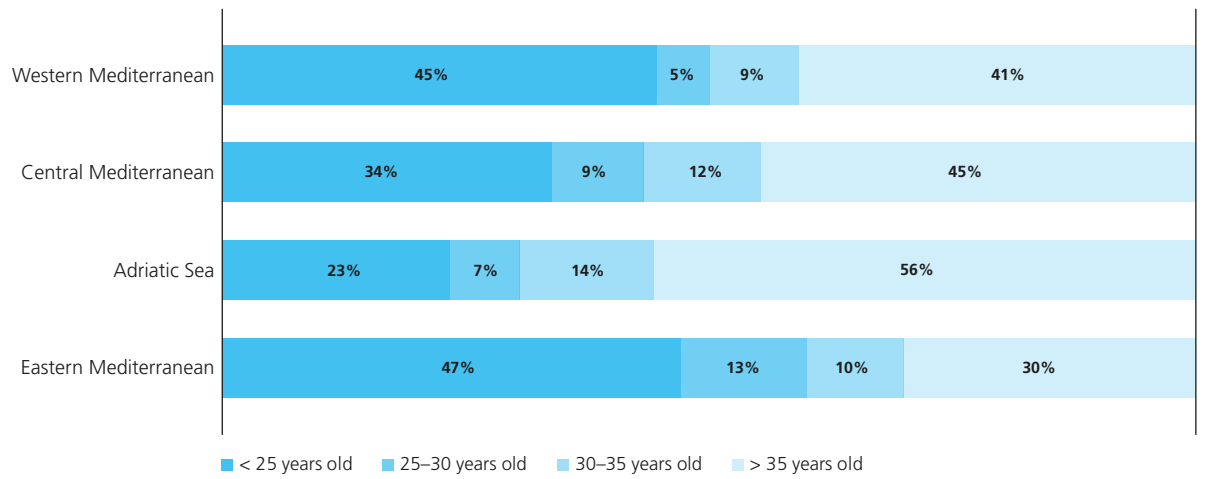


FIGURE 5. Age composition of the fishing fleet in the Mediterranean and the Black Sea



Note: Data coverage is 71.5 percent for the Mediterranean Sea and 88.8 percent for the Black Sea.

FIGURE 6. Age composition of the fishing fleet by Mediterranean subregion



A breakdown of the available information on the year of vessel construction, which benefits from much improved data coverage from the Black Sea (88.8 percent) than previously (26 percent), reveals different patterns in the Mediterranean and the Black Sea (Figure 5). In particular, the age range to which the greatest number of vessels in the Mediterranean fleet belongs is 35 years old (41 percent), whereas the Black Sea hosts a younger fleet, with most vessels under 25 years old (59 percent).

From a subregional perspective, the analysis based on age range shows that in the eastern Mediterranean and the Black Sea, there is a clear prevalence of vessels under 25 years old (47 percent and 59 percent, respectively), while the subregion with the oldest fleet is the Adriatic Sea, with 56 percent of vessels over 35 years old (Figure 6).

FISHING FLEET SEGMENTS

The analysis of the fishing fleet segments (Box 6) operating in the Mediterranean and the Black Sea over the period 2020–2021 is based on a total number of 47 segments – defined as the intersections between all predefined vessel groups and all length classes (Box 7). As with the results reported in *The State of Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a), this analysis revealed a heterogeneous approach to data collection among countries. Several CPCs have continued aggregating and then communicating their data to the GFCM by combining different length classes of the same vessel groups. Subsequently, the length ranges of some fleet 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 2022*, the 47 fleet segments by which CPCs report data have been sorted into four fleet

Box 6. 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 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 predefined vessel groups and all length classes. Any proposal for the aggregation of fleet segments should be brought to the attention of relevant GFCM subsidiary bodies, mentioning the rationale and corresponding references (e.g. available scientific studies) that should confirm the similarity and homogeneity of the combined cells.

Proposed fleet segments (combining 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:
- Some potential combinations are proposed in orange (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 during 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.

segment groups, as outlined in Table 6. These groups remain the same as in previous editions of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2016, 2018, 2020a).

Although this heterogeneity prevents an in-depth comparison of all fleet segments at the national level, the data[4] show that around 82 percent of the total fishing vessels operating in the GFCM area of application (Mediterranean and Black Sea) belong to the group "Small-scale vessels", followed by "Trawlers and beam trawlers" (8.3 percent), "Purse seiners and pelagic trawlers" (5.2 percent) and finally "Other fleet segments" (4.5 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 (84.1 percent) compared to the Mediterranean (82.2 percent); similarly, the fleet segment group "Trawlers and beam trawlers" has

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

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

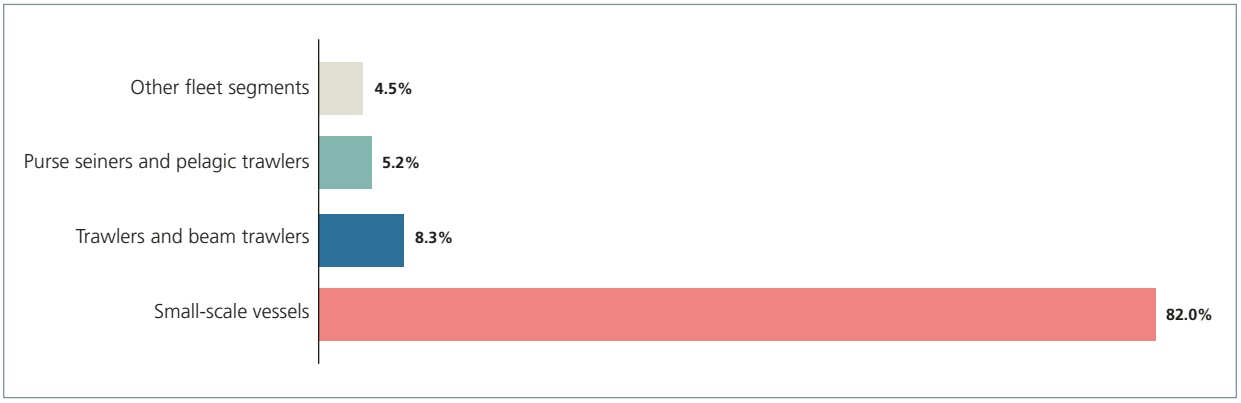
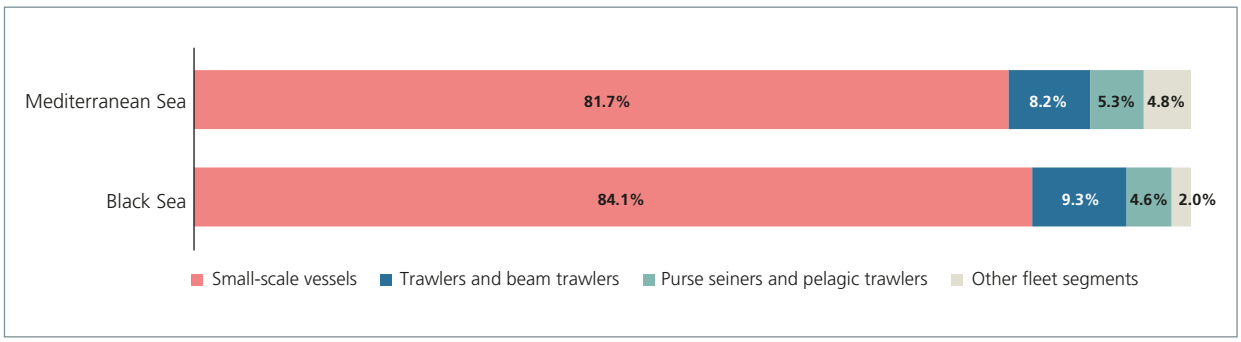


FIGURE 8. Fleet segment composition in the Mediterranean and the Black Sea



approximately the same importance in the two areas (9.3 percent in the Black Sea and 8 percent in the Mediterranean Sea) (Figure 8).

Based on the available information (Table 7), the "Small-scale vessels" group represents more than 90 percent of the operating fishing fleet in nine countries – seven in the Mediterranean Sea (Croatia, Cyprus, Greece, Israel, Lebanon, Tunisia and Türkiye) and two in the Black Sea (Bulgaria and Ukraine).

Without considering unallocated fishing vessels, the "Small-scale vessels" group ranges from accounting for 72.6 percent of the fleet in the western Mediterranean to 86.6 percent in the central Mediterranean; the "Trawlers and beam trawlers" group ranges from 5.5 percent in the central Mediterranean to 13 percent in the Adriatic Sea; the "Purse seiners and pelagic trawlers" group ranges from 2.9 percent in the Adriatic Sea 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 central Mediterranean (20 672 vessels, 30.3 percent of the total) and in the eastern Mediterranean (19 064 vessels, 27.9 percent of the total).

In contrast, the "Trawlers and beam trawlers" group shows a quite even spread across the western Mediterranean (1 686 vessels, 25.2 percent), the Adriatic Sea (1 381 vessels, 20.6 percent), the central Mediterranean (1 303 vessels, 19.5 percent) and the eastern Mediterranean (1 298 vessels, 19.4 percent).

Finally, the "Purse seiners and pelagic trawlers" group shows the most imbalanced geographical distribution, with the western Mediterranean accounting for 46.3 percent of the total vessels in the fleet segment group (2 002 vessels).

Box 7. 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" (19.2 percent)
  - "Small-scale vessels with engines using passive gear 0–6 m" (19.1 percent)
  - "Polyvalent vessels 6–12 m" (16.6 percent)
  - "Small-scale vessels without engines using passive gear 0–12 m" (8.9 percent)
- Trawlers and beam trawlers
  - "Trawlers 12–24 m" (4.8 percent)
  - "Trawlers > 6 m" (1.2 percent)
  - "Trawlers > 24 m" (1.1 percent)
  - "Trawlers 6–12 m" (0.6 percent)
- Purse seiners and pelagic trawlers
  - "Purse seiners > 12 m" (1.6 percent)
  - "Purse seiners 12–24 m" (1.3 percent)
  - "Purse seiners 6–12 m" (1.2 percent)
  - "Purse seiners > 24 m" (0.4 percent)
- Other fleet segments
  - "Polyvalent vessels 12–24 m" (1.5 percent)
  - "Longliners 12–24 m" (1.1 percent)
  - "Dredgers 12–24 m" (0.8 percent)
  - "Longliners > 6 m" (0.6 percent)

The most common fleet segment group is "Small-scale vessels with engines using passive gear" (48 percent), though "Small-scale vessels without engines" and "Trawlers" are also quite prevalent, representing 10.9 percent and 7.3 percent respectively of the region's vessels.

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

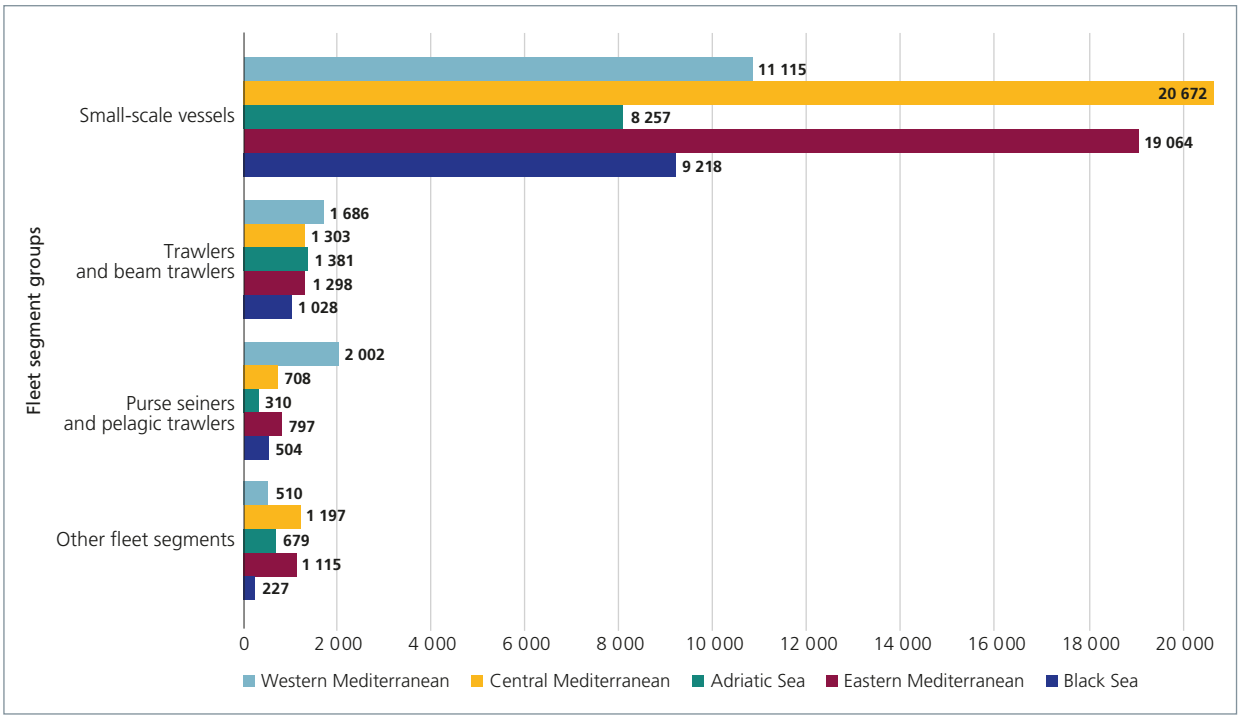
CPCs, non-contracting parties and relevant non-state actors	Fleet segment group					Total	
	Small-scale vessels	Trawlers and beam trawlers	Purse seiners and pelagic trawlers	Other fleet segments	Unallocated	**Vessels**	%
Mediterranean Sea							
Albania	337	125	17	1		**480**	**0.6**
Algeria	3 953	559	1 434	28		**5 974**	**8.0**
Croatia	5 707	334	169	25		**6 235**	**8.4**
Cyprus	744	5	0	38		**787**	**1.1**
Egypt	1 697	824	210	880		**3 611**	**4.9**
France	1 226	89	12	96		**1 423**	**1.9**
Greece	11 699	240	228	99		**12 266**	**16.5**
Israel	336	17	11	2		**366**	**0.5**
Italy	6 680	2 102	414	1 115		**10 311**	**13.9**
Lebanon	1 602	0	53	20		**1 675**	**2.3**
Libya	2 719	212	115	662		**3 708**	**5.0**
Malta	485	16	6	118		**624**	**0.8**
Montenegro	165	10	16	0		**191**	**0.3**
Morocco	2 893	160	137	49		**3 238**	**4.4**
Palestine	858	13	186	0		**1 057**	**1.4**
Portugal	0	0	0	1		**1**	**-**
Slovenia	63	9	0	0		**72**	**0.1**
Spain	974	595	219	226		**2 015**	**2.7**
Syrian Arab Republic					1 300	**1 300**	**1.7**
Tunisia	12 081	433	484	83		**13 081**	**17.6**
Türkiye	5 388	230	145	87		**5 850**	**7.9**
Total	**59 608**	**5 974**	**3 855**	**3 528**	**1 300**	**74 265**	
%	**80.2**	**8.0**	**5.2**	**4.8**	**1.8**		
Black Sea							
Bulgaria	1 105	5	55	17		**1 182**	**10.8**
Georgia					49	**49**	**0.4**
Türkiye	7 404	993	426	142		**8 965**	**81.6**
Romania	73	20	18	19		**130**	**1.2**
Ukraine	614	4	0	43		**661**	**6.0**
Total	**9 196**	**1 022**	**499**	**221**	**49**	**10 987**	
%	**83.7**	**9.3**	**4.5**	**2.0**	**0.5**		

Notes:
Bosnia and Herzegovina and Monaco are not included in the table. These countries reported to the GFCM Secretariat that they had no operating fishing fleet at the time this publication was being prepared. Additionally, the Russian Federation provided no data to the GFCM Secretariat on its fishing fleet as relating to the GFCM area of application.

TABLE 8. Percentage of 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	72.6	86.6	77.7	85.6	84.0
Trawlers and beam trawlers	11.0	5.4	13.0	5.8	9.3
Purse seiners and pelagic trawlers	13.1	3.0	2.9	3.6	4.6
Other fleet segments	3.3	5.0	6.4	5.0	2.1

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



©FAO/Abla Kadiri

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 (GSAs 28 and 29)[5] are here reported at the subregional, regional 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 2020 data on landings and 2021 data on ports.

The analysis is based on information from two distinct sources that feed into the existing GFCM regional databases on capture fisheries production. The first one provides data on annual catch by species and FAO subdivision reported by Mediterranean and Black Sea countries through the FAO/GFCM STATLANT 37A questionnaire to FAO and the GFCM (FAO, 2020b). The STATLANT questionnaire was developed by the FAO Coordinating Working Party on Fishery Statistics and is annually sent out by the Organization on behalf of the GFCM to relevant national authorities; it covers the time series from 1970 to 2020 (the method used to estimate capture fisheries production from this

[5] 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 report, the Black Sea subregion encompasses the Marmara Sea and the Black Sea (GSAs 28 and 29) but excludes the Azov Sea (GSA 30).

source is explained in Box 8). 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 GFCM binding recommendations, mainly through the Data Collection Reference Framework (DCRF) (see Box 2); these data cover the 2018–2020 time series.

The tables and figures in this chapter are all based on the existing FAO and GFCM data on capture fisheries production. As in *The State of the Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a), the analysis in this chapter has 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) (FAO, 2022a), whose fisheries are under the management of the International Commission for the Conservation of Atlantic Tunas (ICCAT). When comparing current data with data from earlier editions of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2016, 2018), this change has been corrected by eliminating such 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 1 000 000 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 1 087 100 tonnes, and subsequently declined irregularly to 760 000 tonnes in 2015. Over the following three years, production reached 805 700 tonnes in 2018, but it notably decreased to 674 500 tonnes in 2020. 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 over the period 1996–1998 and then fluctuations until 2020, when the total reported landings in the Black Sea were 416 900 tonnes (Figure 10). The drop in catch in 2020 was also likely exacerbated by COVID-19 restrictions (Box 10), which not only included temporal closures on fishing activity, but also led to a decrease in demand linked to the nearly total shutdown of tourism and impacts on trade (GFCM, 2020a, 2020b).

Box 8. 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.[1] At the end of this process, missing values must be estimated in order to ensure coherence with the FAO Global Capture Production Database,[2] at least for FAO International Standard Statistical Classification for Aquatic Animals and Plants (ISSCAAP) groups of species.[3]

The following ISSCAAP groups have been excluded from the analysis of catch carried out in this report:

- 11 – Carps, barbels and other cyprinids
- 13 – Miscellaneous freshwater fishes
- 36 – Tunas, bonitos, billfishes
- 41 – Freshwater crustaceans
- 91 – Brown seaweeds
- 92 – Red seaweeds
- 94 – Miscellaneous aquatic plants.

[1] **FAO.** 2020. GFCM capture production (1970–2020). In: *General Fisheries Commission for the Mediterranean*. Rome. Cited 29 November 2022. www.fao.org/gfcm/data/captureproduction

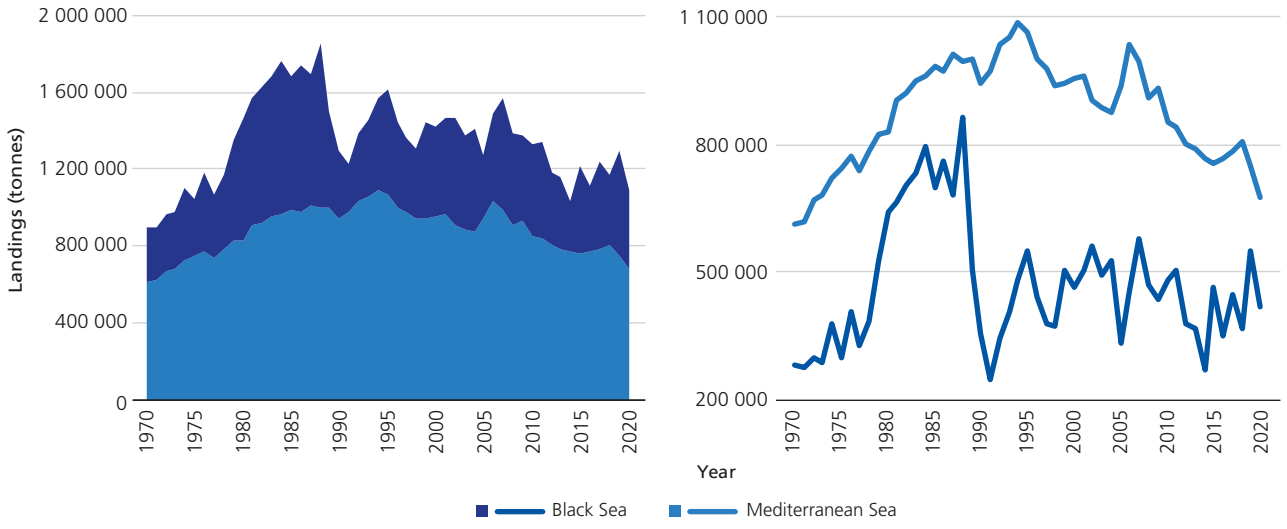
[2] **FAO.** 2021. Global capture production. In: *FAO Fisheries and Aquaculture*. Rome. Cited 21 November 2022. www.fao.org/fishery/en/collection/capture

[3] **FAO.** 2022. ASFIS List of Species for Fishery Statistics Purposes. In: *FAO Fisheries and Aquaculture*. Rome. Cited 21 November 2022. www.fao.org/fishery/en/collection/asfis/en

The combined average landings for the Mediterranean and the Black Sea over the 2018–2020 period amount to 1 189 200 tonnes (743 100 tonnes in the Mediterranean, accounting for 62.5 percent of the total, and 446 100 tonnes in the Black Sea). This value is slightly higher (1.1 percent) than the catch from the 2016–2018 period, with a decrease of 5.7 percent in the Mediterranean Sea and an increase of 15 percent in the Black Sea. The landings time series (1970–2020) of the largest producers (Figure 11), as well as of countries catching up to 150 000 tonnes and of countries catching up to 20 000 tonnes, are reported in Figure 12 and Figure 13 for reference.

Averaging over the period 2018–2020 in the GFCM area of application (Table 9 and Figure 14) reveals Türkiye as the main producer (327 200 tonnes; 27.5 percent of the total), followed by Italy (155 700 tonnes; 13.1 percent), Tunisia (95 600 tonnes; 8 percent) – which has grown into the third largest producer (it was fourth for the period 2016–2018) – and Algeria (95 500 tonnes; 8 percent). Other countries that contribute at least 5 percent of the total catch are Georgia (90 000 tonnes; 7.6 percent), Greece (73 600 tonnes; 6.2 percent), Spain (70 600 tonnes; 5.9 percent) and Croatia (67 500 tonnes; 5.7 percent). All the remaining

FIGURE 10. Total landings in the Mediterranean and the Black Sea per year, 1970–2020



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

FIGURE 11. Total landings of the two largest producers (Türkiye and Italy) per year, 1970–2020

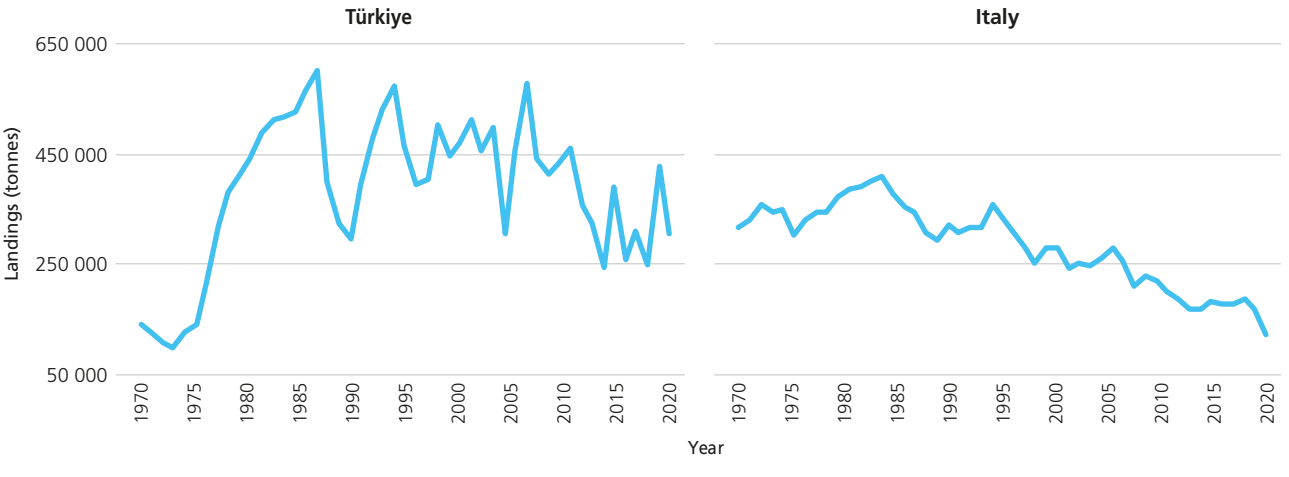


FIGURE 12. Total landings per year by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor catching up to 150 000 tonnes, 1970–2020

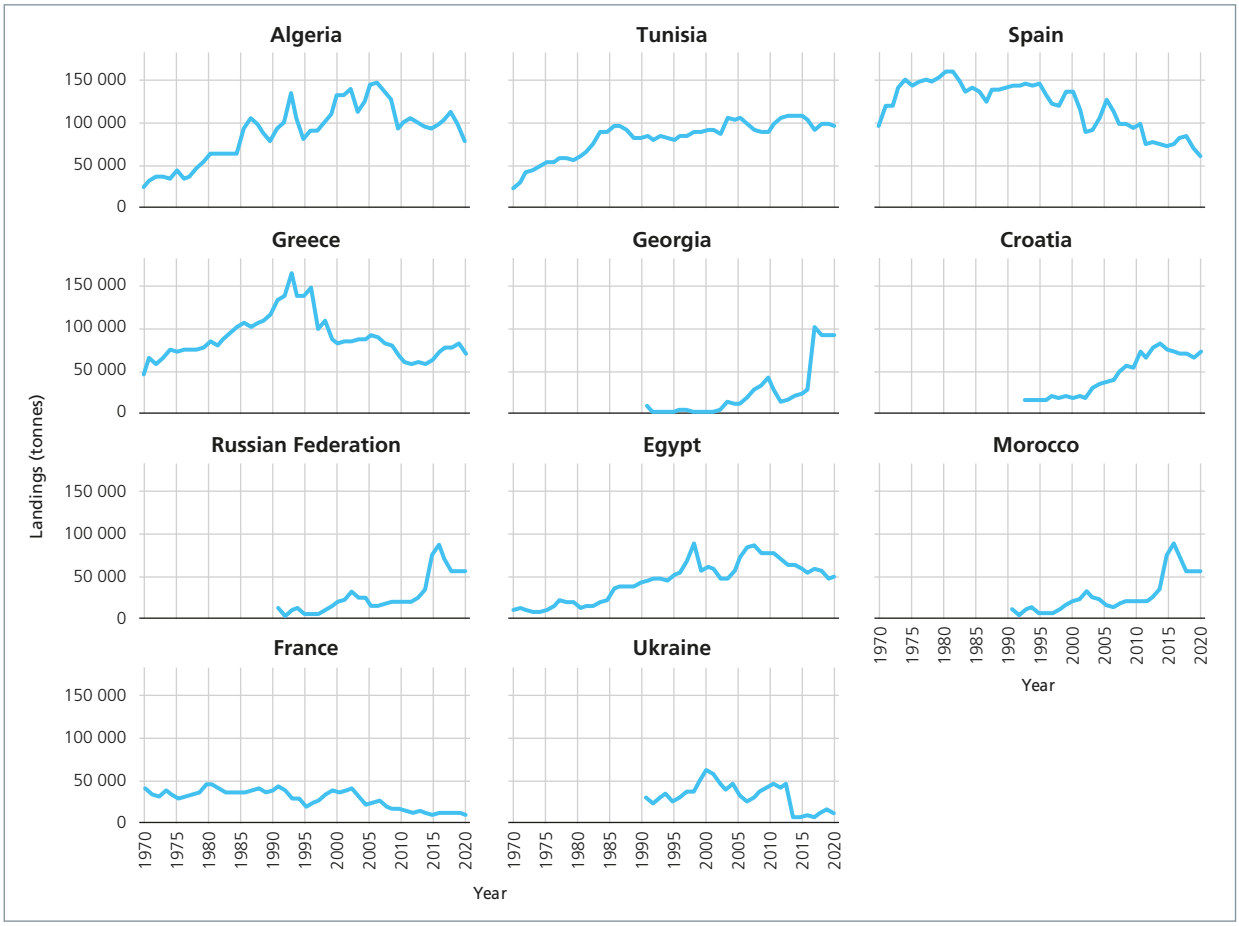


FIGURE 13. Total landings per year by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor catching up to 20 000 tonnes, 1970–2020

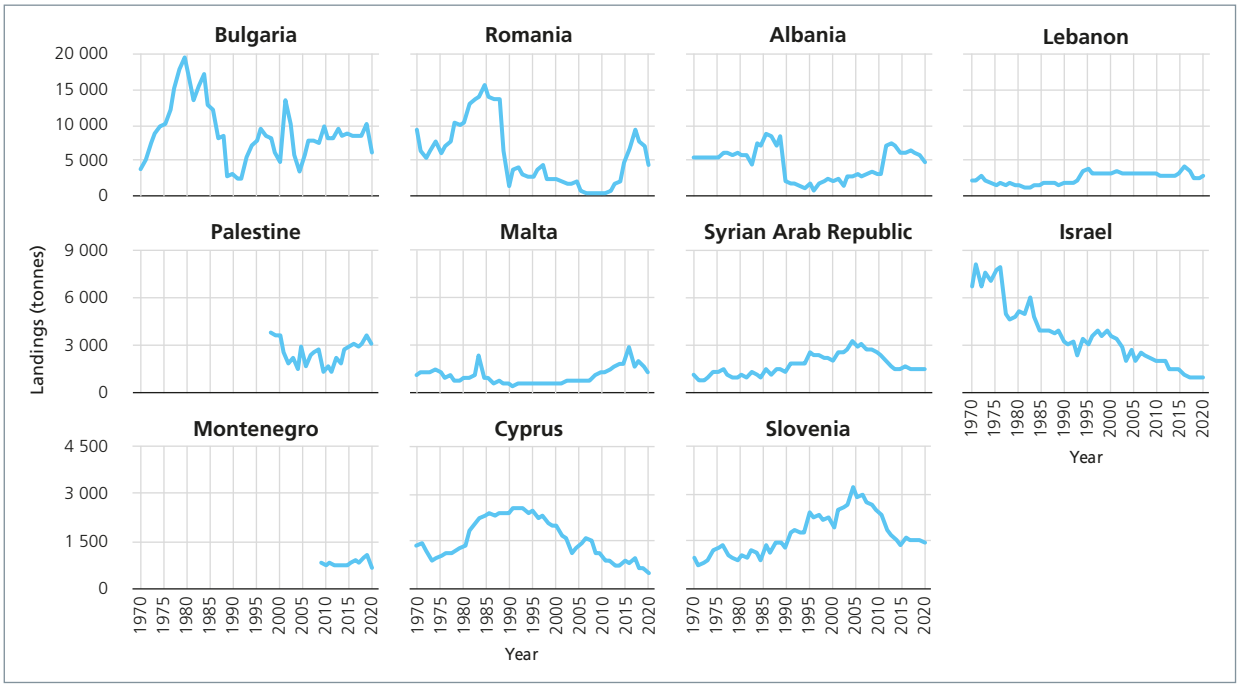


TABLE 9. Total landings per year by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor, 2018–2020

CPCs, non-contracting parties and non-state actors	Landings			Average	% variation	
	2018	2019	2020	2016–2018	2018–2019	2019–2020
Albania	6 113	5 753	4 579	**5 482**	-5.89	-20.41
Algeria	111 322	97 149	77 981	**95 484**	-12.73	-19.73
Bosnia and Herzegovina	5	5	5	**5**	0.00	0.00
Bulgaria	8 522	10 266	6 196	**8 328**	20.46	-39.65
Croatia	69 142	63 053	70 201	**67 465**	-8.81	11.34
Cyprus	654	642	484	**593**	-1.88	-24.65
Egypt	54 097	45 767	47 788	**49 217**	-15.40	4.42
France	12 498	12 581	10 476	**11 852**	0.67	-16.73
Georgia	90 057	89 922	90 160	**90 046**	-0.15	0.27
Greece	73 690	79 307	67 808	**73 602**	7.62	-14.50
Israel	985	983	983	**984**	-0.20	0.00
Italy	182 834	164 851	119 293	**155 659**	-9.84	-27.64
Lebanon	2 534	2 282	2 690	**2 502**	-9.96	17.89
Libya	30 219	30 215	29 515	**29 983**	-0.01	-2.32
Malta	1 986	1 642	1 327	**1 652**	-17.32	-19.17
Monaco	1	1	1	1	–	–
Montenegro	1 016	1 047	626	**896**	3.07	-40.18
Morocco	23 997	22 065	28 531	**24 865**	-8.05	29.30
Palestine	3 000	3 582	3 070	**3 217**	19.40	-14.29
Portugal	52	25	41	**40**	-51.17	61.16
Romania	7 745	7 149	4 463	**6 452**	-7.70	-37.57
Russian Federation*	54 664	55 177	54 363	**54 735**	0.94	-1.47
Slovenia	134	135	156	**142**	1.21	15.41
Spain	82 057	69 887	59 829	**70 591**	-14.83	-14.39
Syrian Arab Republic	1 508	1 508	1 473	**1 496**	0.00	-2.32
Tunisia	95 956	95 850	95 083	**95 629**	-0.11	-0.80
Türkiye	250 303	426 893	304 462	**327 219**	70.55	-28.68
Ukraine	9 117	14 094	9 833	**11 015**	54.59	-30.23

*Information provided by the Russian Federation, including statistical data for the Autonomous Republic of Crimea and the city of Sevastopol, Ukraine, temporarily occupied by the Russian Federation.

countries combined account for 17.9 percent with 213 450 tonnes).

In the Mediterranean Sea, on average (2018–2020), Italy continues to be the main producer (20.9 percent), followed by Tunisia (12.9 percent), Algeria (12.8 percent), Greece (9.9 percent), Spain (9.5 percent), Croatia (9.1 percent), Türkiye (7 percent) and Egypt (6.6 percent) (Figure 11, Figure 12 and Figure 15). The highest percentage increase in the Mediterranean Sea is shown by Morocco (24 900 tonnes, contributing 3.3 percent of all Mediterranean landings), which increases its contribution by 7.3 percent compared to the period 2016–2018; by contrast, Italy's landings decrease to around 155 700 tonnes, which represents a decline of 12.8 percent compared to the period 2016–2018 (Figure 17).

In addition to the CPCs described above, others that have shifted in the rankings from *The State of Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a) include Libya (30 000 tonnes; 4 percent), whose contribution to Mediterranean landings increased by 4 percent compared to the period 2016–2018, and Spain, whose landings decreased by around 10 percent (70 600 tonnes),

in contrast to the increase recorded over 2016–2018 (Table 9, Figure 17).

In the Black Sea, on average (2018–2020), Türkiye dominates the catch (275 500 tonnes; 61.8 percent), accounting for a higher percentage of landings compared to 2016–2018, over which period it accounted for 57.6 percent. The other countries are Georgia (90 000 tonnes; 20.2 percent), the Russian Federation (54 800 tonnes; 12.3 percent), Ukraine (11 000 tonnes; 2.5 percent), Bulgaria (8 300 tonnes; 1.9 percent) and Romania (6 500 tonnes; 1.4 percent) (Figure 16). The most evident increase compared to the period 2016–2018 is shown by Türkiye (52 300 tonnes; +23.4 percent), followed by Georgia (17 900 tonnes; +24.9 percent), and Ukraine (3 800 tonnes; +53 percent). The Bulgarian catch remains rather constant, whereas Romania has decreased its contribution to Black Sea landings by around 19.8 percent (a difference of 1 600 tonnes) (Table 9, Figure 16 and Figure 17).

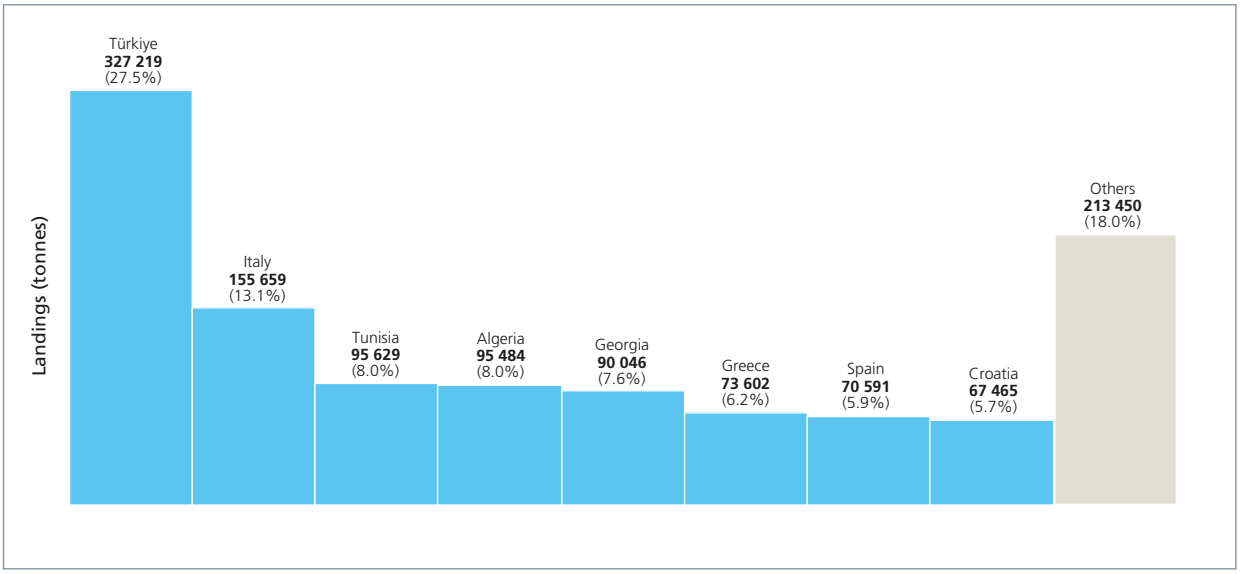
In 2020, the majority of the countries showed a decrease in catch, likely linked to the impacts of the COVID-19 pandemic (GFCM, 2020a, 2020b).

With the contribution of each fleet component to the average 2018–2020 landings data taken into account, as transmitted by CPCs through the DCRF Task II.1 "Landings", and the fleet segments defined as in Chapter 1, the group "Purse seiners and pelagic trawlers" continues to be the segment responsible for the largest share of total landings (54.4 percent), accounting for 48.3 percent in the Mediterranean Sea and 68.6 percent in the Black Sea (Figure 18). The group "Trawlers and beam trawlers" makes the second largest contribution to total landings (21.3 percent), with a greater importance in the Mediterranean Sea (25.3 percent) than in the Black Sea (11.8 percent). The group "Small-scale vessels" has a higher impact in the Mediterranean Sea (18.5 percent) than in the Black Sea (8.2 percent). Finally, the miscellaneous group "Other fleet segments" accounts for 8.9 percent of the total, with a slightly higher share of landings in the Black Sea (11.5 percent) than in the Mediterranean (7.9 percent) (Figure 18).

MAIN SPECIES AND GROUPS CONTRIBUTING TO CAPTURE FISHERIES PRODUCTION

The three species groups most caught over the period 2018–2020 remain the same as those from the average landings reported in *The State of Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a): "Herrings, sardines, anchovies" (665 500 tonnes), "Miscellaneous coastal fishes" (117 400 tonnes) and "Miscellaneous pelagic fishes" (88 100 tonnes). These three groups

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, 2018–2020



combined constitute 73.3 percent of the total reported landings in the entire GFCM area of application, representing a slight increase from 72.3 percent over the period 2016–2018. Seven other species groups contributing more than 1.5 percent to the total landings amount to 21.7 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 percent overall (Table 10 and Figure 19).

The average landings of the main species groups (2018–2020) have been also analysed by country in the GFCM area of application (Figure 20). Türkiye and Italy account for the highest percentages of landings for most species groups. Türkiye represents 33.8 percent of the average landings of "Herrings, sardines, anchovies" (224 800 tonnes); 27.7 percent of "Miscellaneous pelagic fishes" (24 400 tonnes); 62.4 percent of "Clams, cockles and arkshells" at

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, 2018–2020

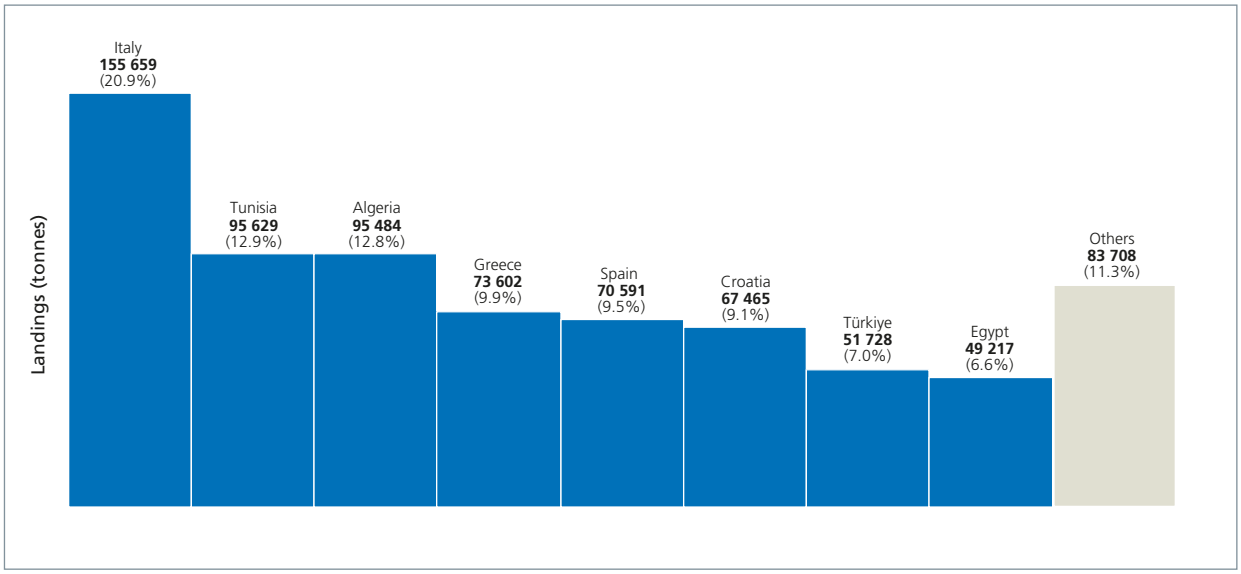


FIGURE 16. Average annual landings by GFCM contracting party, cooperating non-contracting party and non-contracting party in the Black Sea, 2018–2020

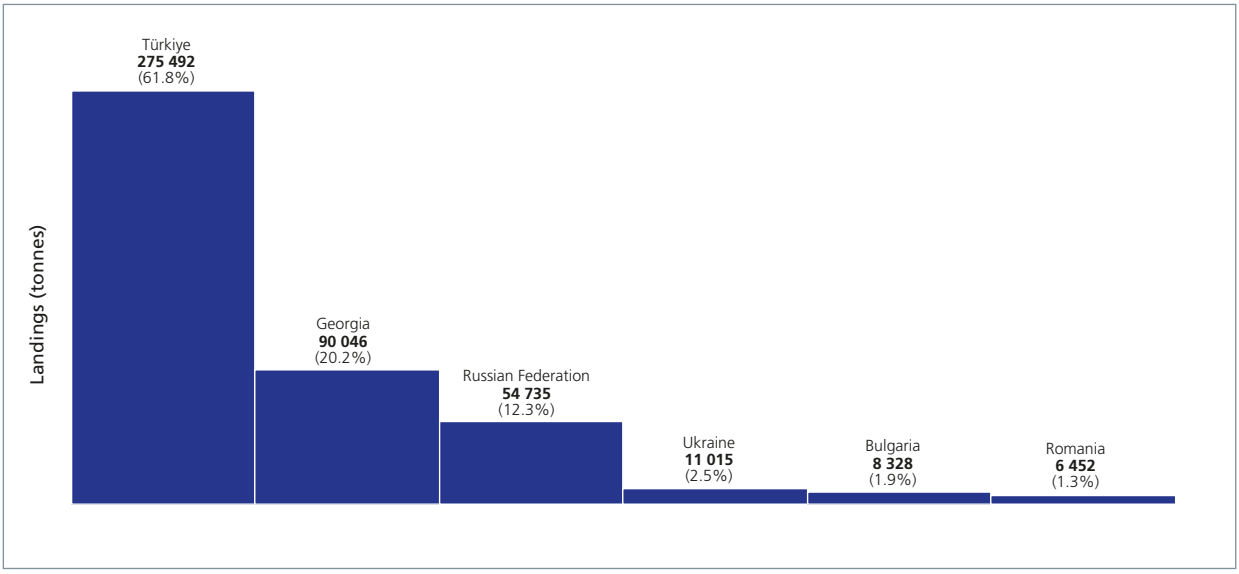


FIGURE 17. Percentage variation between total landings recorded over 2016–2018 and total landings recorded over 2018–2020 by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor

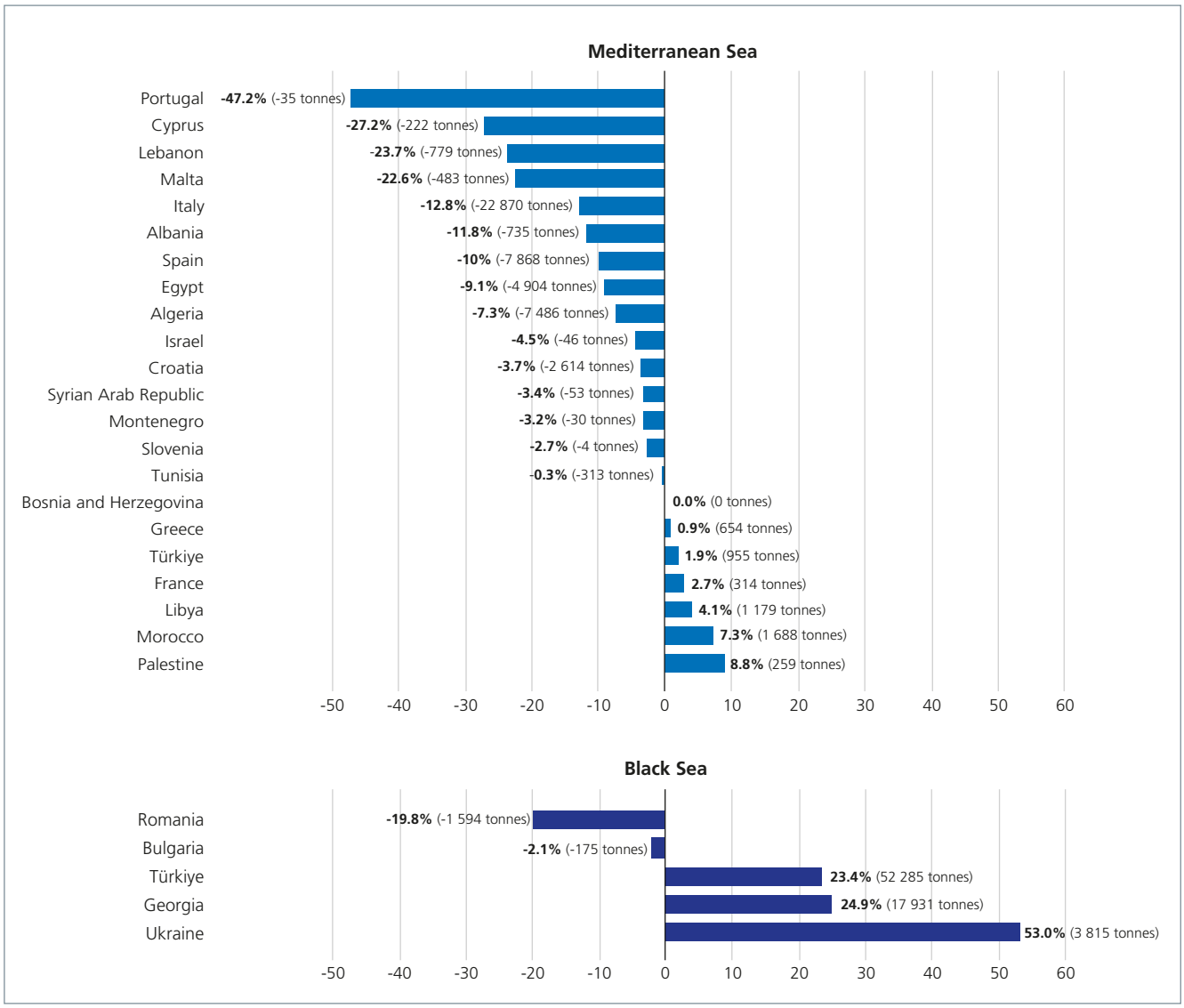


FIGURE 18. Relative contributions of the four fleet segment groups to total landings, 2018–2020

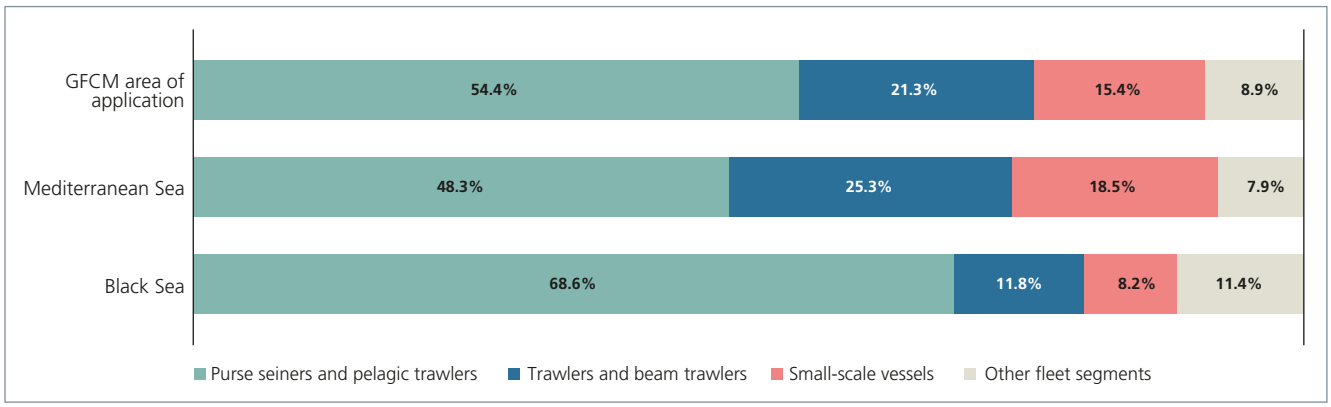
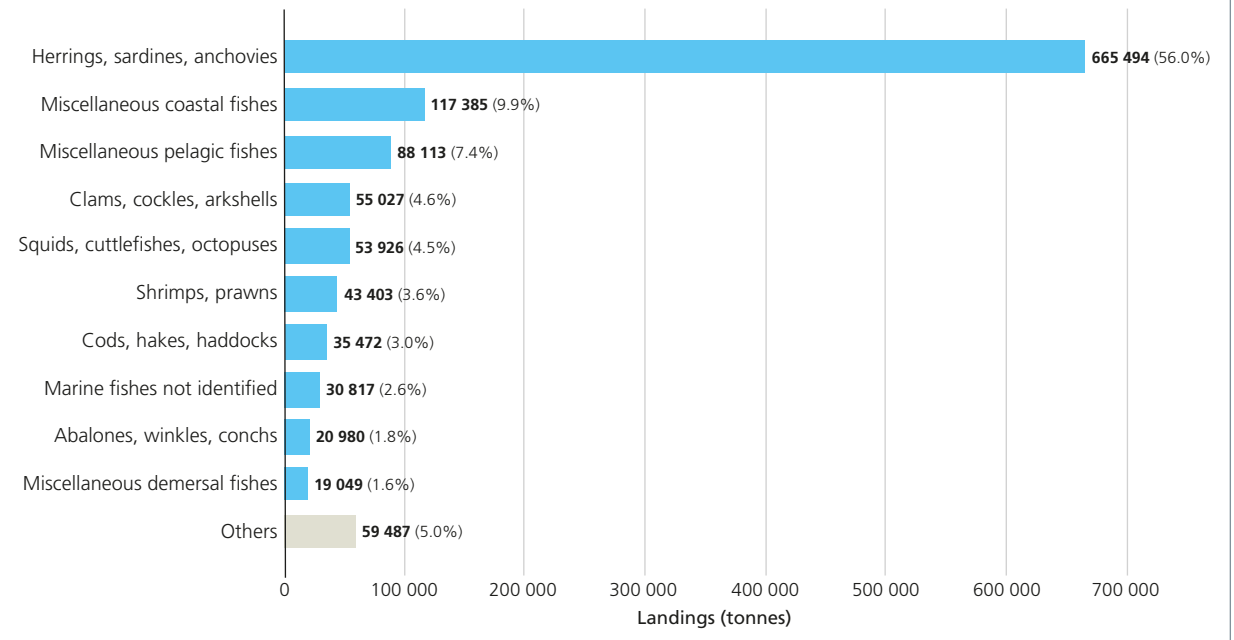


TABLE 10. Total landings per year by main species group in the GFCM area of application, 2018–2020

Species groups	Landings (tonnes)				
	2018	2019	2020	Average	% contribution
Herrings, sardines, anchovies	615 479	759 556	621 447	**665 494**	56.0
Miscellaneous coastal fishes	122 971	117 999	111 183	**117 385**	9.9
Miscellaneous pelagic fishes	96 048	91 368	76 923	**88 113**	7.4
Clams, cockles, arkshells	62 620	56 839	45 623	**55 027**	4.6
Squids, cuttlefishes, octopuses	60 840	54 714	46 225	**53 926**	4.5
Shrimps, prawns	45 727	43 294	41 189	**43 403**	3.6
Cods, hakes, haddocks	36 170	37 361	32 884	**35 472**	3.0
Marine fishes not identified	32 435	31 946	28 070	**30 817**	2.6
Abalones, winkles, conchs	20 405	26 180	16 354	**20 980**	1.8
Miscellaneous demersal fishes	20 180	20 873	16 094	**19 049**	1.6
Others	61 333	61 700	55 421	**59 485**	5.0

Note: % contribution indicates relative contributions of each main species group to total landings in the GFCM area of application, 2018–2020 average.

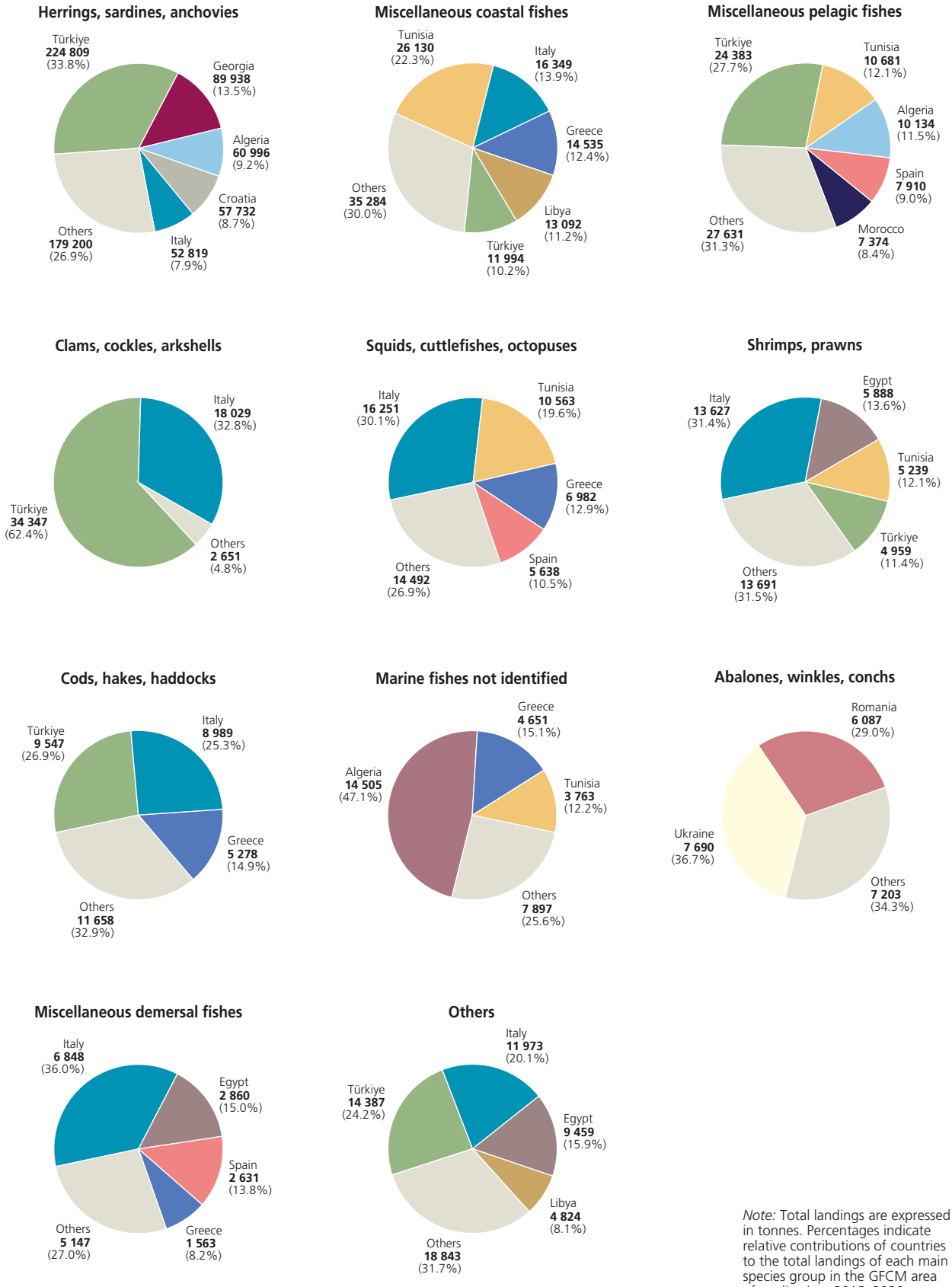
FIGURE 19. Total landings per year by main species group in the GFCM area of application, 2018–2020



Note: Percentages indicate relative contributions of each main species group to total landings in the GFCM area of application, 2018–2020 average.

34 400 tonnes (followed by Italy with 32.8 percent and 2 700 tonnes); 26.9 percent of "Cods, hakes, haddocks" at 9 950 tonnes (followed by Italy with 25.3 percent and 9 000 tonnes); and 24.2 percent of other groups at 14 390 tonnes (followed by Italy with 20.1 percent and 11 970 tonnes). Italy lands 30.1 percent of "Squids, cuttlefishes, octopuses" (16 300 tonnes); 31.4 percent of "Shrimps, prawns" (13 600 tonnes); and 35.9 percent of "Miscellaneous demersal fishes" (6 850 tonnes), ranking first for these three species groups. In addition, Tunisia appears among the top capture producers for some species groups: it is first for "Miscellaneous coastal fishes" at 26 100 tonnes and 22.3 percent (followed by Italy with 13.9 percent); second for "Miscellaneous pelagic fishes (10 700 tonnes, 12.1 percent) and "Squids, cuttlefishes, octopuses"

FIGURE 20. Total landings of main species groups by country in the GFCM area of application, 2018–2020 average



Note: Total landings are expressed in tonnes. Percentages indicate relative contributions of countries to the total landings of each main species group in the GFCM area of application, 2018–2020 average.

(10 600 tonnes and 19.6 percent); and third for "Shrimps, prawns" (5 200 tonnes and 12.1 percent) and "Marine fishes not identified" (3 800 tonnes and 12.2 percent).

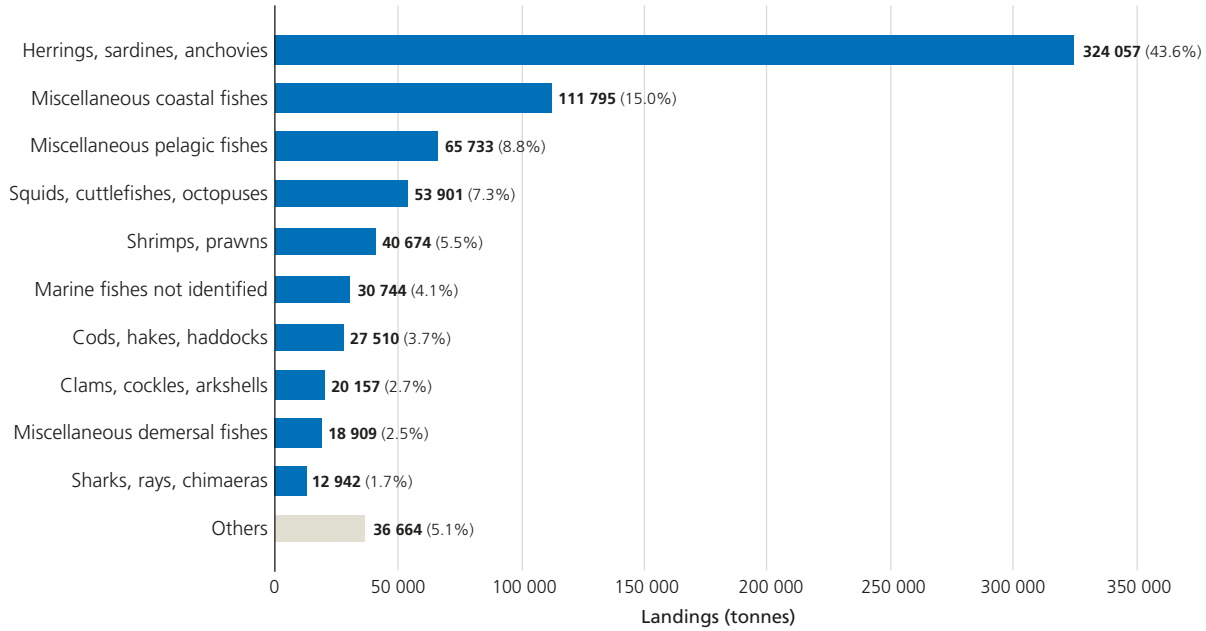
For "Herrings, sardines, anchovies", the remaining catch excluding Türkiye is dominated by Georgia (13.5 percent), Algeria (9.2 percent), Croatia (8.7 percent) and Italy (7.9 percent), with all other countries combined accounting for 7.4 percent. Meanwhile, "Miscellaneous coastal fishes" are mostly landed in Greece, Libya and Türkiye, while "Miscellaneous pelagic fishes" are mostly caught in Algeria, Spain and Morocco.

Other recurring countries among the main producers of these species groups are Egypt (ranking second for "Shrimps, prawns" and "Miscellaneous demersal fishes" and third for "Others") and Ukraine (first for "Abalones, winkles, conchs").

The main species groups comprising Mediterranean Sea landings show very similar percentages in calculations for the whole GFCM area of application, except for "Clams, cockles, arkshells" (2.7 percent in the Mediterranean Sea and 4.6 percent in the whole GFCM area of application) and "Abalones, winkles, conchs", which are not present in Mediterranean Sea catches. Nonetheless, the contribution of small pelagic species (i.e. the combination of "Herrings, sardines, anchovies" and "Miscellaneous pelagic fishes") is moderately lower (52.4 percent of Mediterranean landings versus 63.4 percent of total GFCM area of application landings). A slight increase is noted for "Miscellaneous coastal fishes" (5.1 percent more than in the whole GFCM area of application) and "Squids, cuttlefishes, octopuses" (2.8 percent more) (Figure 21).

In the Black Sea (Figure 22), the situation is opposite, with small pelagic species dominating (in particular "Herrings, sardines, anchovies" at 76.5 percent of total landings) compared to the Mediterranean (43.6 percent) (Figure 21) 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 2.7 percent of the catch, "Clams, cockles, arkshells" are more relevant (the second largest group in terms of importance, representing 7.8 percent of the total catch, i.e. 3.2 percent more than in the whole GFCM area of application) (Figure 19). "Shrimps and prawns", on the other hand, represent a very low percentage of the catch (contributing 0.6 percent of Black Sea landings, i.e. 3 percent less than in the whole GFCM area of application) and are therefore included in the "Others" group (Figure 22).

FIGURE 21. Total landings by main species group in the Mediterranean Sea, 2018–2020 average



Note: Percentages indicate relative contributions of each main species group to total landings in the Mediterranean Sea, 2018–2020 average.

FIGURE 22. Total landings by main species group in the Black Sea, 2018–2020 average

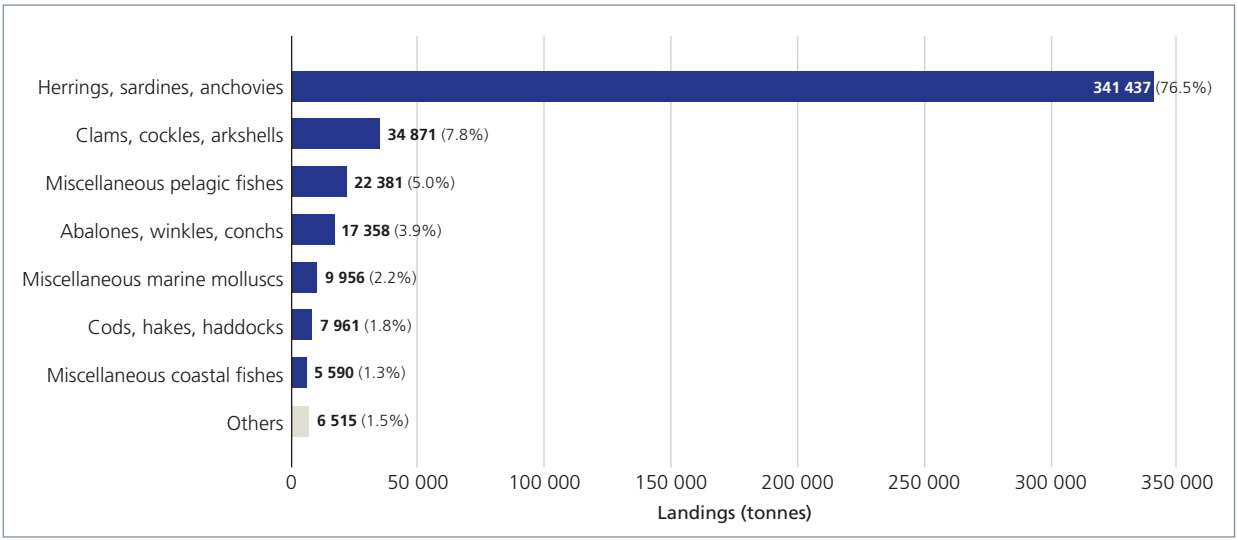
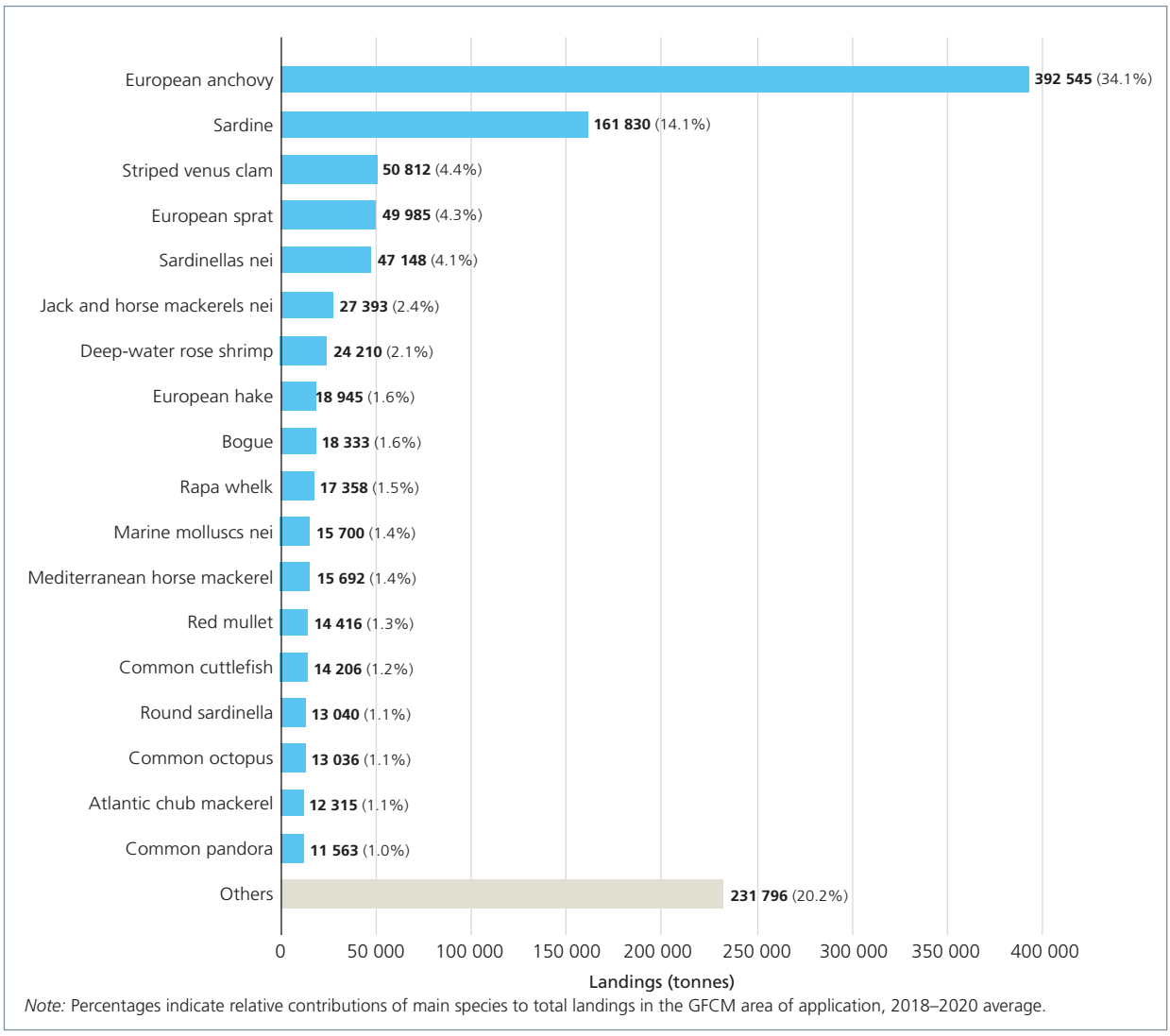


TABLE 11. Total landings per year by main commercial species accounting for more than 1 percent of total landings in the GFCM area of application, 2018–2020

Common name	Species (or group)	Landing (tonnes)				% contribution
		2018	2019	2020	Average	
European anchovy	*Engraulis encrasicolus*	329 342	477 657	370 637	**392 545**	34.1
Sardine	*Sardina pilchardus*	190 248	155 667	139 576	**161 830**	14.1
Striped venus clam	*Chamelea gallina*	58 665	52 716	41 056	**50 812**	4.4
European sprat	*Sprattus sprattus*	38 881	62 274	48 800	**49 985**	4.3
Sardinellas nei	*Sardinella* spp.	46 618	46 335	48 492	**47 148**	4.1
Jack and horse mackerels nei	*Trachurus* spp.	27 748	30 910	23 522	**27 393**	2.4
Deep-water rose shrimp	*Parapenaeus longirostris*	25 911	24 016	22 703	**24 210**	2.1
European hake	*Merluccius merluccius*	20 170	19 342	17 324	**18 945**	1.6
Bogue	*Boops boops*	19 711	18 570	16 720	**18 333**	1.6
Rapa whelk	*Rapana venosa*	16 523	22 325	13 225	**17 358**	1.5
Marine molluscs nei	Mollusca	15 714	17 225	14 163	**15 700**	1.4
Mediterranean horse mackerel	*Trachurus mediterraneus*	18 326	17 268	11 481	**15 692**	1.4
Red mullet	*Mullus barbatus*	16 092	14 504	12 654	**14 416**	1.3
Common cuttlefish	*Sepia officinalis*	11 848	16 460	14 309	**14 206**	1.2
Round sardinella	*Sardinella aurita*	8 538	17 222	13 359	**13 040**	1.1
Common octopus	*Octopus vulgaris*	12 026	14 784	12 297	**13 036**	1.1
Atlantic chub mackerel	*Scomber colias*	12 270	11 154	13 522	**12 315**	1.1
Common pandora	*Pagellus erythrinus*	11 658	11 735	11 296	**11 563**	1.0
Others		258 368	230 586	206 434	**231 796**	20.2

Note: % contribution indicates relative contribution of each main commercial species to total landings in the GFCM area of application, 2018–2020 average.

FIGURE 23. Total landings by main species contributing at least 1 percent of the total catch in the GFCM area of application, 2018–2020 average



Note: Percentages indicate relative contributions of main species to total landings in the GFCM area of application, 2018–2020 average.

Across the GFCM area of application, European anchovy (*Engraulis encrasicolus*) and sardine (*Sardina pilchardus*) continue to be the main species captured (392 500 tonnes and 161 800 tonnes on average, respectively), followed by striped venus clam (*Chamalea gallina*) and European sprat (*Sprattus sprattus*) (50 800 tonnes and 50 000 tonnes on average, respectively). Fourteen species appear in the list of species contributing more than 1 percent to the total catch: four molluscs – marine molluscs nei, rapa whelk (*Rapana venosa*), common cuttlefish (*Sepia officinalis*) and common octopus (*Octopus vulgaris*); one crustacean – deep-water rose shrimp (*Parapenaeus longirostris*); four demersal species – bogue (*Boops boops*), European hake (*Merluccius merluccius*), red mullet (*Mullus barbatus*) and common pandora (*Pagellus erythrinus*); and five pelagic species – *Trachurus* spp., Mediterranean horse mackerel (*Trachurus mediterraneus*), *Sardinella* spp., round sardinella (*Sardinella aurita*) and Atlantic chub mackerel (*Scomber colias*) (Table 11 and Figure 23).

Trends in landings of the main priority species over the period of 1970–2020 (Figure 24, Figure 25 and Table 11) 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 in 1970 to 370 600 tonnes in 2020, with an intermediate collapse between 1989 and 1992 (reaching a minimum of 161 400 tonnes in 1991) that was followed by an irregular trend. An important fluctuation is also noted for

FIGURE 24. Landings per year of priority species averaging higher than 5 000 tonnes between 2018–2020 in the GFCM area of application, 1970–2020

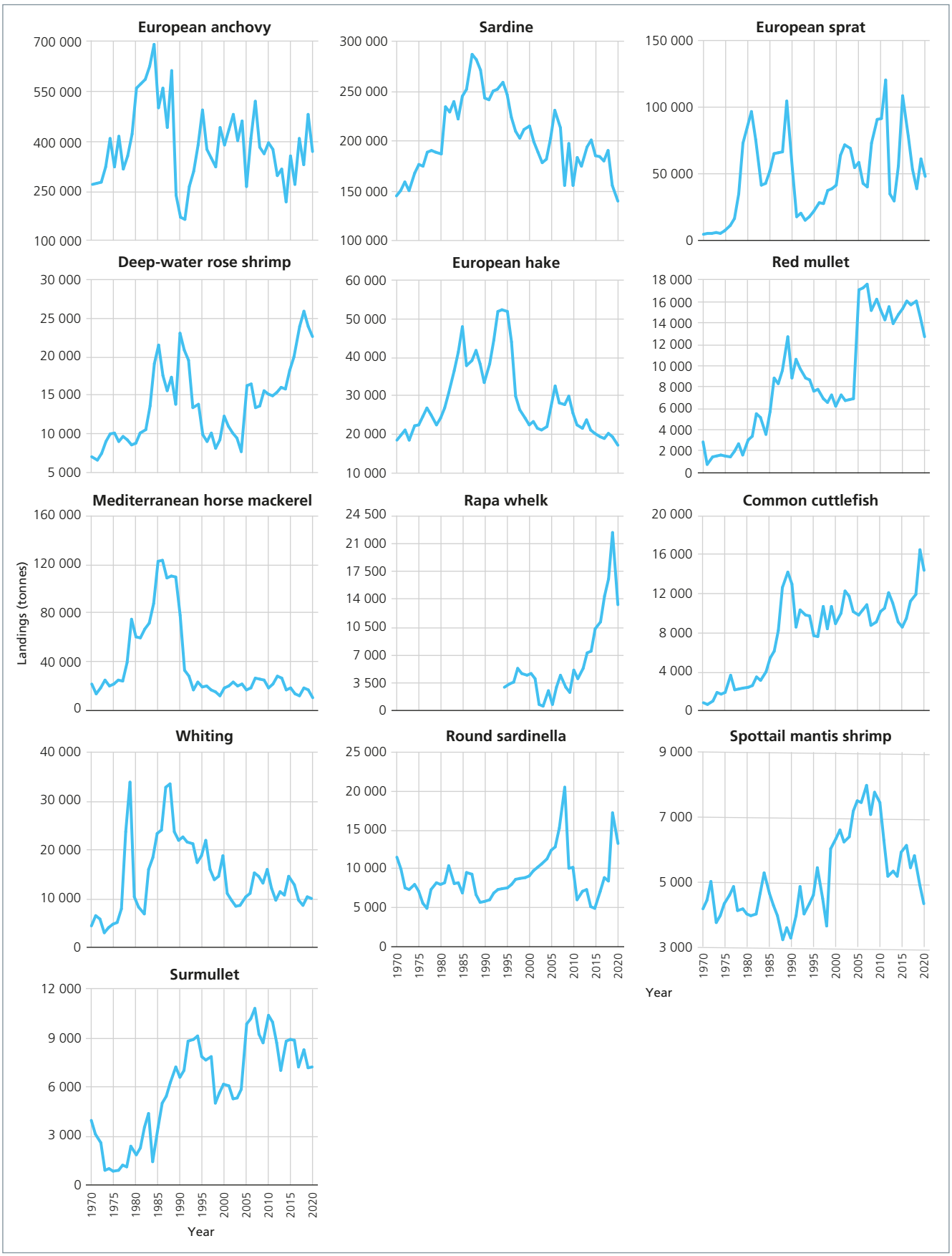
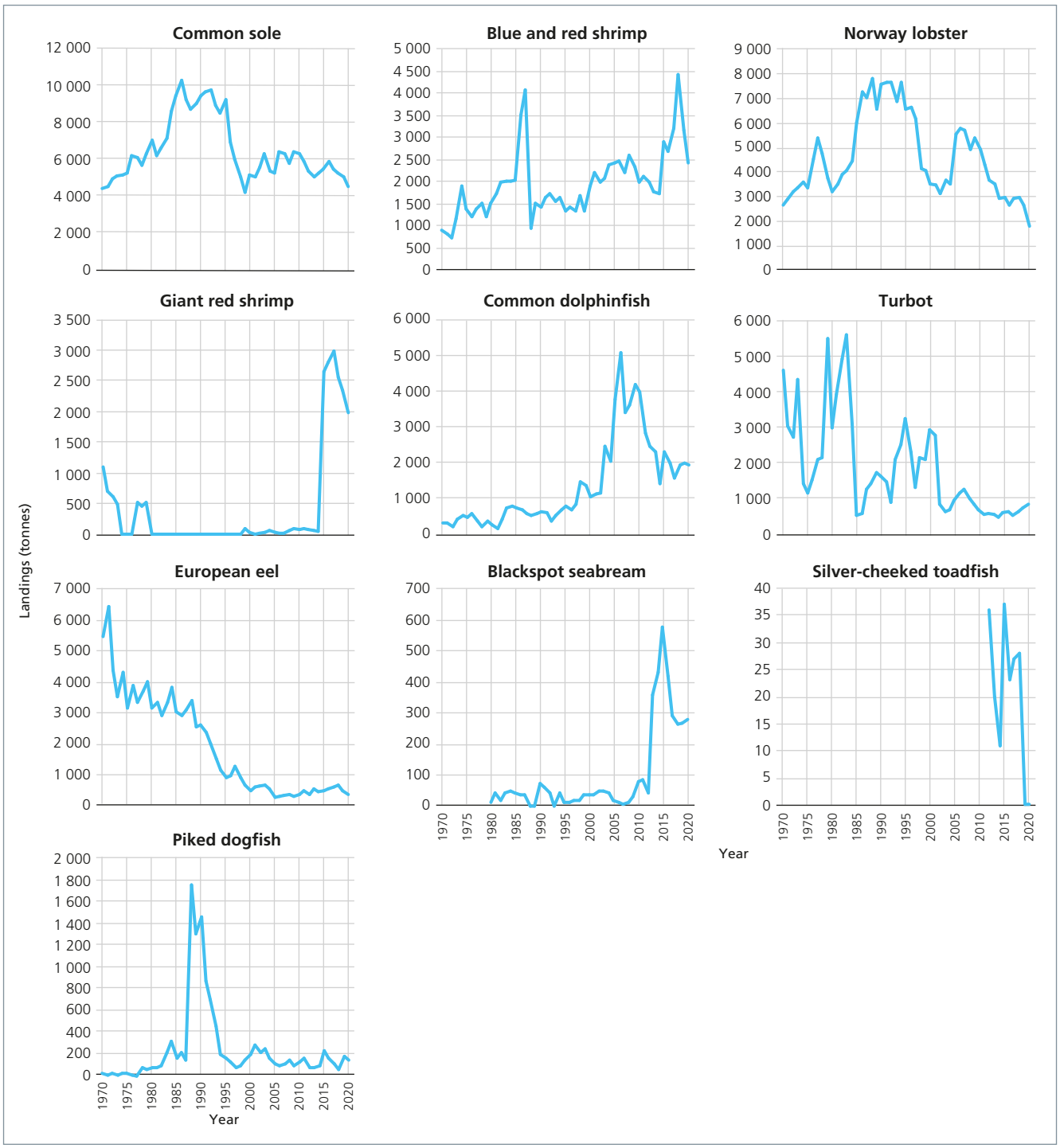
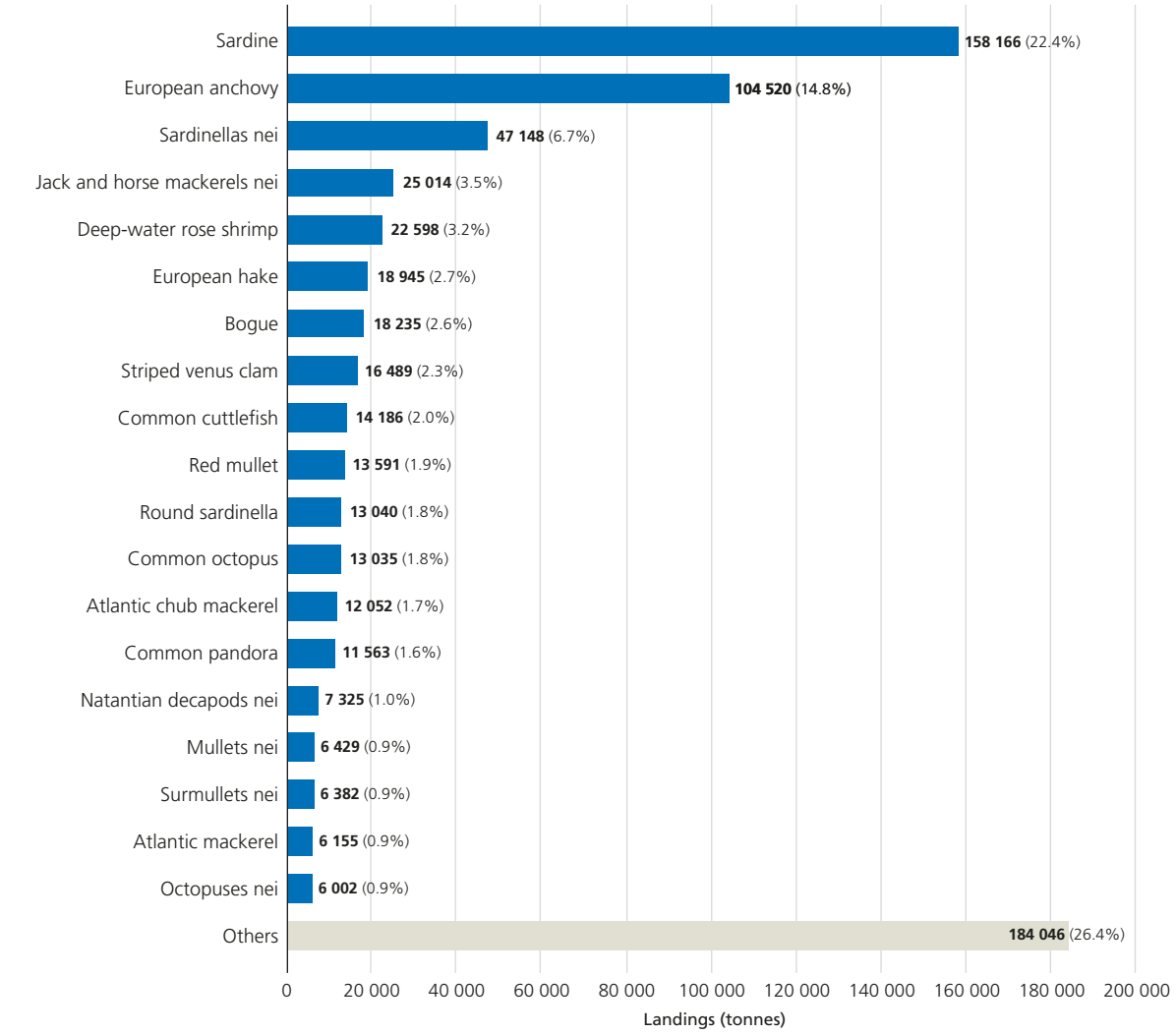


FIGURE 25. Landings per year of priority species averaging lower than 5 000 tonnes between 2018–2020 in the GFCM area of application, 1970–2020



European sprat, with landing values oscillating from a minimum of around 4 400 tonnes in 1970 through a maximum of 120 900 tonnes in 2011 to 48 800 tonnes in 2020. Round sardinella landings rose from 11 600 tonnes (1970) to 13 400 tonnes (2020), with a peak of 20 500 tonnes in 2008. On the other hand, Mediterranean horse mackerel 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 until 2020, with a three-year average of 15 700 tonnes. As for demersal species, European hake, whiting (*Merlangius merlangus*), Norway lobster (*Nephrops norvegicus*) and turbot

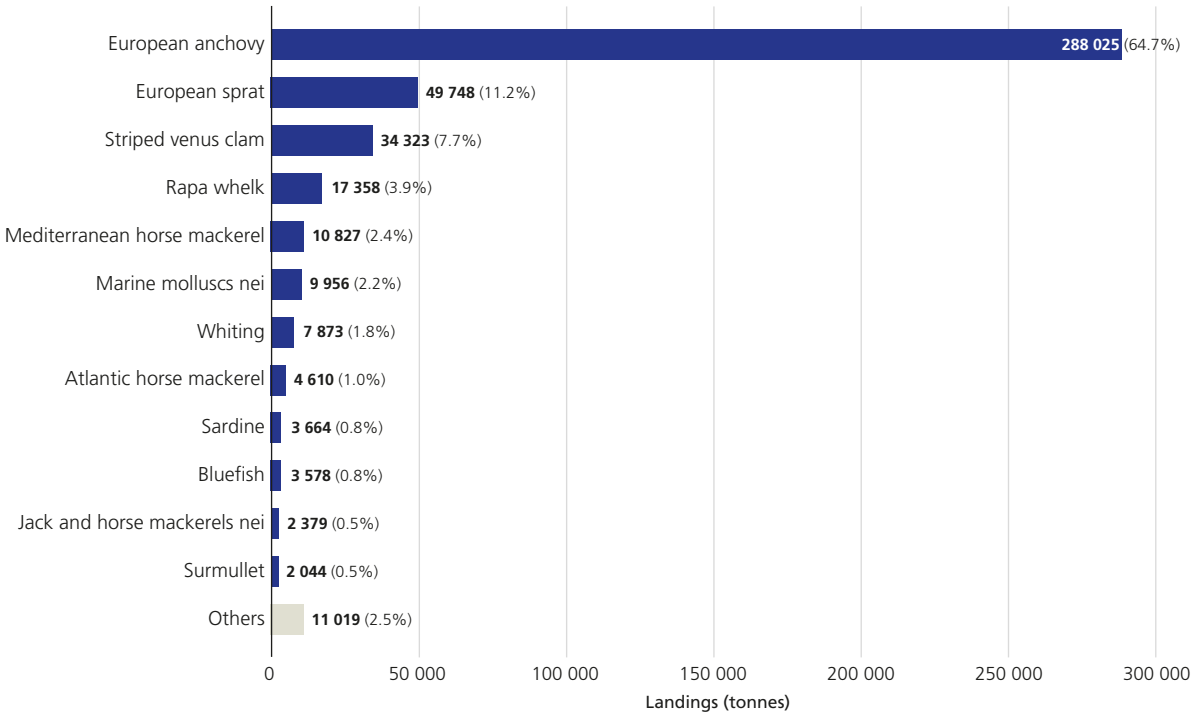
FIGURE 26. Total landings by main species contributing at least 1 percent of the total catch in the Mediterranean Sea, 2018–2020 average



Note: Percentages indicate relative contributions of main species to total landings in the Mediterranean Sea, 2018–2020 average.

(*Scophthalmus maximus*) show continuous declines in catch since the 1980s–1990s, while common sole (*Solea solea*) shows an abrupt decline in the late 1990s (from more than 8 000 tonnes 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 molluscs and most of the crustacean species, i.e. common cuttlefish, rapa whelk, deep-water rose shrimp, spottail mantis shrimp (*Squilla mantis*), 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 very recently: deep-water rose shrimp (25 900 tonnes in 2018 and 24 200 on average over the past three years), rapa whelk (22 300 tonnes in 2019 and 17 400 on average over the past three years), blue and red shrimp (4 400 tonnes in 2018 and 3 300 on average over the past three years) and giant red shrimp (2 900 tonnes in 2017 and 2 300 on average over the past three years). On the other hand, for species of conservation concern such as European eel (*Anguilla anguilla*) and piked dogfish (*Squalus acanthias*), steep declines in catch, with close to zero in recent years, have been observed (Figure 24 and Figure 25). In 2020, declines in catch of the main priority species in Figure 24 (with the exception of whiting and surmullet, whose catch remained

FIGURE 27. Total landings by main species contributing at least 0.5 percent of the total catch in the Black Sea, 2018–2020 average



Note: Percentages indicate relative contributions of main species to total landings in the Black Sea, 2018–2020 average.

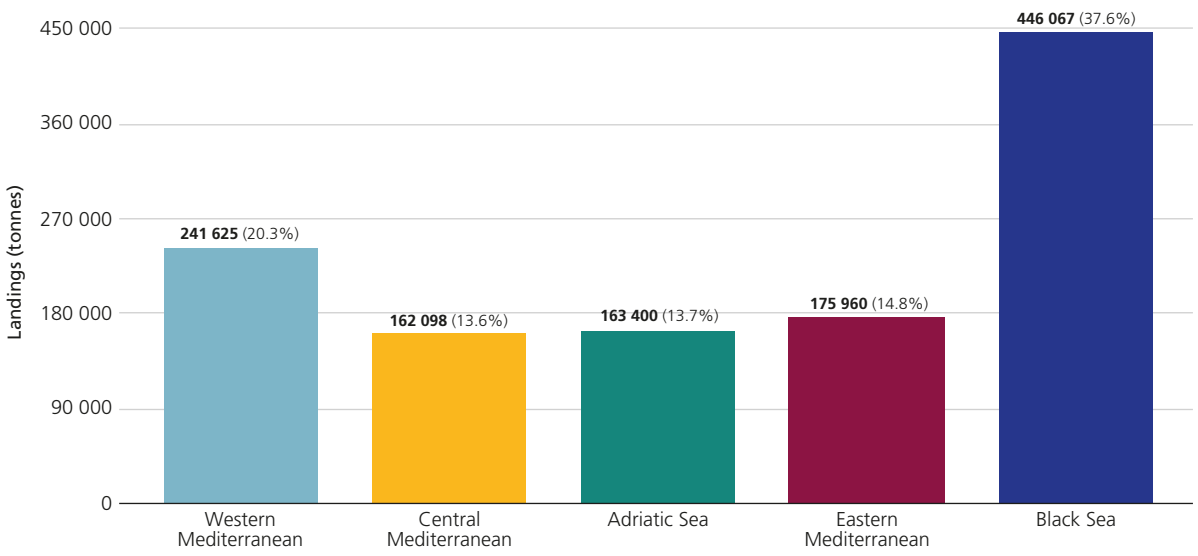
quite stable), were most likely linked to impacts caused by the COVID-19 pandemic.

Two priority species are not included in Figure 25. The first one is red coral (*Corallium rubrum*) whose FAO data have differed from its GFCM data since 2013, when GFCM data sources became the official submissions made and validated by CPCs to the GFCM in line with Recommendation GFCM/36/2012/1 on further measures for the exploitation of red coral in the GFCM area of application, subsequently repealed by Recommendation GFCM/43/2019/4 on a management plan for the sustainable exploitation of red coral in the Mediterranean Sea. On the other hand, FAO statistics also include catch estimates based on trade information. The second species not included is Atlantic bonito (*Sarda sarda*), which has been listed recently as one of the priority species for the Black Sea, with a total catch ranging from 20 700 tonnes (1970) to 27 100 tonnes (2020) across the entire GFCM area of application.

In 2020, declines in the catch of the priority species in Figure 25 (except for turbot and blackspot seabream [*Pagellus bogaraveo*], whose catch increased slightly), were most likely linked to the COVID-19 pandemic.

In the Mediterranean basin, sardine (14.8 percent) and European anchovy (22.4 percent) continue to be the most prevalent species, together accounting for 37.2 percent of total landings (in line with data from the period 2016–2018, which also showed a large diversity of species significantly contributing to the catch, i.e. 17 species accounting for at least 1 percent of total landings). In the Black Sea, the predominant species is undoubtedly Black Sea anchovy (*Engraulis encrasicolus ponticus*), with 64.7 percent of total landings, i.e. 7.4 percent more than reported in FAO (2020a), followed by European sprat with 11.2 percent: both species together account for 75.9 percent of the region's landings, i.e around 3 percent more than over the period 2016–2018 (Figure 26 and Figure 27).

FIGURE 28. Total landings by GFCM subregion, 2018–2020 average



Note: Percentages indicate relative contributions of GFCM subregions to total landings in the GFCM area of application, 2018–2020 average.

CAPTURE FISHERIES PRODUCTION AT THE SUBREGIONAL LEVEL

The breakdown of capture fisheries production by GFCM subregion 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 "Landing data" [operating vessels by GSA and fleet segment] and Task II.2 "Catch data per species" [total catch by GSA and fleet segment for main commercial species]) for the period 2018–2020. After submission, the data were then extrapolated to produce the total catch statistics for the Mediterranean and the Black Sea that are stored in the STATLANT 37A database (FAO, 2020b).

The results of the analysis show that the western Mediterranean continues to be the most productive Mediterranean subregion (20.3 percent of total landings, with 241 600 tonnes). The eastern Mediterranean, the Adriatic Sea and the central Mediterranean have almost the same share of landings, accounting for 14.8 percent (176 000 tonnes), 13.7 percent (163 400 tonnes) and 13.6 percent (162 100 tonnes), respectively. The Black Sea has the highest capture fisheries production in weight overall (37.5 percent of the total, with 446 100 tonnes) (Figure 28).

In general, the dynamics reported in *The State of the Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a) continue to hold true, with the large majority of the catch in each 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 29).

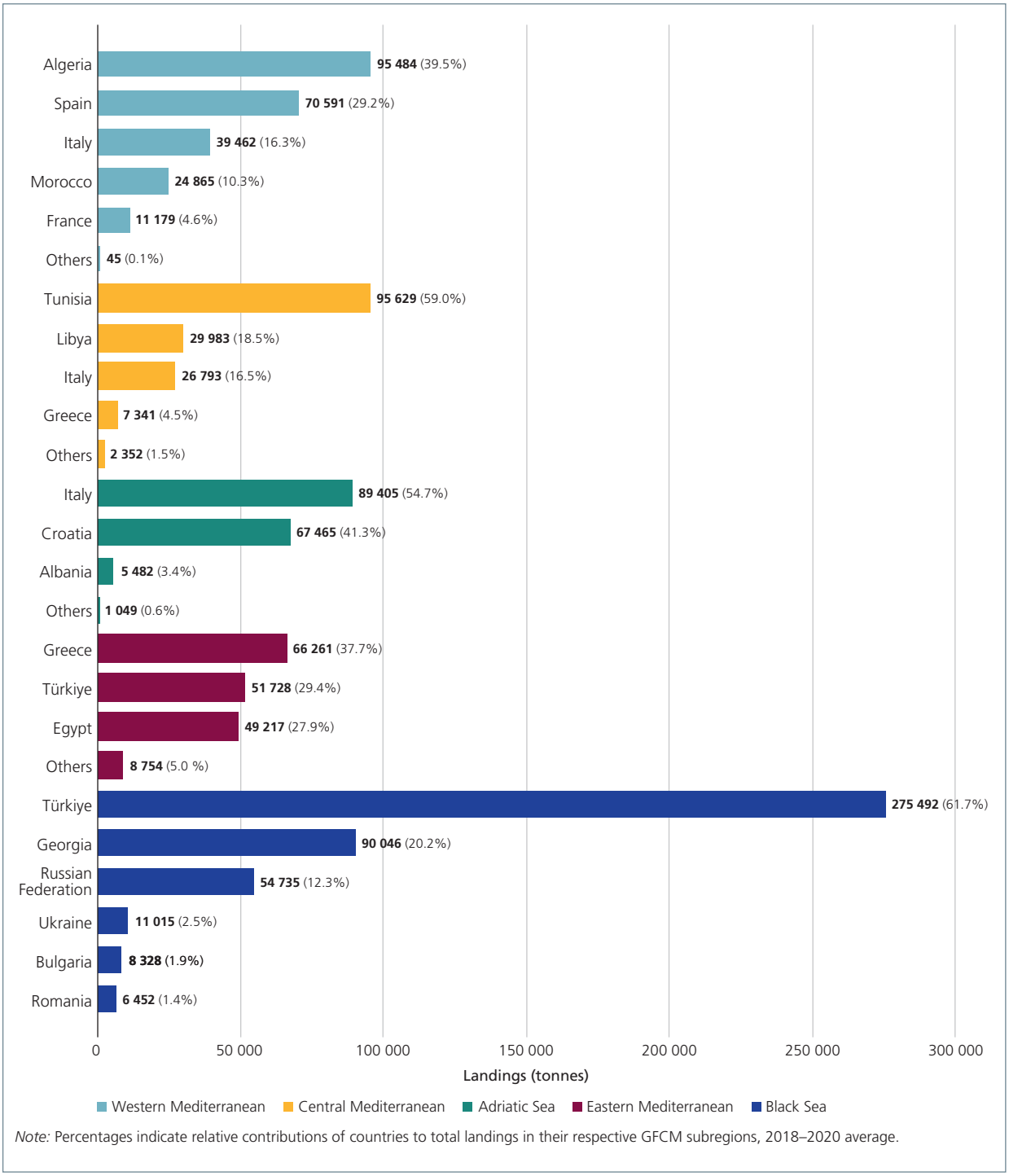
In the western Mediterranean, Algeria (39.5 percent) brings in the largest share of landings by weight, followed by Spain (29.2 percent) and Italy (16.3 percent). The three together account for 85 percent of all landings in the subregion, with Morocco, France and "Others" contributing the remaining 10.3 percent, 4.6 percent and 0.1 percent, respectively.

In the Adriatic Sea, landings by weight are dominated by Italy (54.7 percent) and Croatia (41.3 percent), which account for 96 percent of all landings in the subregion, followed by Albania (3.4 percent) and "Others" (0.6 percent).

In the central Mediterranean, landings by weight are dominated by Tunisia (59 percent), followed by Libya (18.5 percent) and Italy (16.5 percent), the three of which account for 94 percent of all landings in the subregion, followed by Greece (4.5 percent) and "Others" (1.5 percent).

In the eastern Mediterranean, landings by weight are mostly split between Greece (37.7 percent), Türkiye (29.4 percent) and Egypt (27.9 percent), which together account for 95.1 percent of all landings in the subregion, followed by "Others" (5 percent).

FIGURE 29. Average annual landings by country in each GFCM subregion, 2018–2020

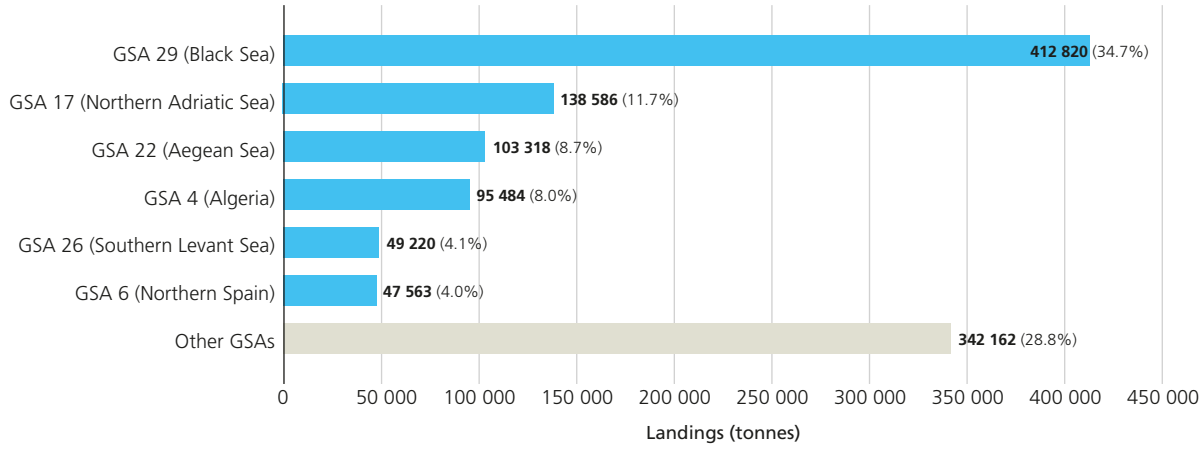


Note: Percentages indicate relative contributions of countries to total landings in their respective GFCM subregions, 2018–2020 average.

Finally, in the Black Sea, Türkiye brings in the largest share of landings by weight (61.7 percent), followed by Georgia (20.2 percent), the Russian Federation (12.3 percent), Ukraine (2.5 percent), Bulgaria (1.9 percent) and Romania (1.4 percent).

A further breakdown of the available data at the GSA level (Figure 30) reveals that six GSAs alone contribute 71.2 percent of total landings in the entire GFCM area of application, amounting to around 847 000 tonnes. Geographical subarea 29 (Black Sea), the largest GSA, has the largest share of landings with 34.7 percent of the total (412 800 tonnes), i.e. about triple the contribution of the second most productive GSA, namely GSA 17 (northern Adriatic Sea), which accounts for 138 600 tonnes (11.7 percent

FIGURE 30. Average annual landings by geographical subarea, 2018–2020



Note: Percentages indicate relative contributions of GSAs to total landings in the GFCM area of application, 2018–2020 average.

of the total). The third most important of the GSAs with landings greater than 100 000 tonnes is GSA 22 (Aegean Sea), accounting for 8.7 percent (103 000 tonnes). Three GSAs show landings between 50 000 and 100 000 tonnes: GSA 4 (Algeria) at 8 percent (95 500 tonnes), GSA 26 (southern Levant Sea) at 4.1 percent (49 200 tonnes) and GSA 6 (northern Spain) at 4 percent (47 600 tonnes). The remaining 23 GSAs all together contribute 28.8 percent of total landings in the entire GFCM area of application, at around 342 200 tonnes (Figure 30).

In 2018, 2020 and 2021, 16.8 percent (125 000 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 received around 37.5 percent (167 000 tonnes) of the total landings in this basin (Box 9).

SUBREGIONAL CAPTURES BY SPECIES

In terms of species contributions to the landings of the different subregions (Figure 31), sardine is the main captured species in the Adriatic Sea (64 900 tonnes, 42.6 percent), the western Mediterranean (49 500 tonnes, 18.2 percent) and the central Mediterranean (16 800 tonnes, 8.9 percent), while European anchovy is the predominant species in the eastern Mediterranean (17 900 tonnes, 13.5 percent) and the Black Sea (123 000 tonnes, 72.1 percent).

In the western Mediterranean, European anchovy (36 200 tonnes, 13.3 percent) and sardinellas nei (*Sardinella* spp.) (25 500 tonnes; 9.4 percent) are the second and the third main species, whereas the remaining 59.1 percent (160 700 tonnes) corresponds to a large number of species contributing to the catch in this region (Figure 31).

In the central Mediterranean, other prevalent species are European anchovy (13 800 tonnes; 7.3 percent), sardinellas nei (13 400 tonnes; 7.1 percent), deep-water rose shrimp (9 900 tonnes; 5.3 percent) and common pandora (9 000 tonnes; 4.8 percent). The sum of all other species, each of which contributes less than 5 percent of the total, constitutes the remaining 66.6 percent, at 125 300 tonnes (Figure 31).

In the Adriatic Sea, four species, namely sardine (64 900 tonnes; 42.5 percent), European anchovy (24 900 tonnes; 16.3 percent), striped venus clam (16 100 tonnes; 10.6 percent) and European hake (3 700 tonnes; 2.4 percent), account for 71.8 percent of the landings. The sum of all other species, each of which contributes less than 5 percent of the total, constitutes the remaining 28.2 percent, at 43 000 tonnes (Figure 31).

In the eastern Mediterranean, sardine (10 900 tonnes; 8.2 percent), marine fishes nei (9 400 tonnes; 7.1 percent) and sardinellas nei (8 300 tonnes; 6.3 percent) are the other prevalent species, with all others together accounting for the remaining 64.9 percent with 85 900 tonnes (Figure 31).

Box 9. 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 in 2022 among the countries in the region, since the necessary information was not requested through any existing GFCM recommendations. Fifteen countries responded to the data call for the reference year 2021 (Albania, Algeria, Bulgaria, Cyprus, Croatia, France, Greece, Italy, Libya, Malta, Morocco, Slovenia, Spain, Romania and Türkiye), three countries for 2020 (Israel, Montenegro and Tunisia), and five countries for 2018 (Bosnia and Herzegovina, Egypt, Georgia, Syrian Arab Republic and Ukraine).

Main ports in terms of volume of landings

Based on the available information, the ten main ports in terms of volume of landings in the GFCM area of application are distributed as follows: four in the Mediterranean Sea (two Egyptian and two Tunisian) and six in the Black Sea (one Georgian and five Turkish). This group of ports receives around 15.4 percent of total landings in the GFCM area of application, while its combined operating vessels account for about 8.2 percent of the total fleet.

The breakdown by area shows that the ten most important ports in terms of volume of landings in the Mediterranean Sea, which together receive around 16.1 percent of the total landings, are all located in the southern part of the basin (three in Egypt, five in Tunisia and one in Algeria), with the exception of one Italian port.

With regard to the Black Sea, nine of the main ports in terms of volume of landings are Turkish and one is Georgian. Together, they account for around 37.5 percent of the total landings in this area.

Main ports in terms of operating vessels

The ranking of the ten main ports across the 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, the ten main ports according to these criteria are all located in the Mediterranean Sea (five Tunisian, three Moroccan and two Libyan). Together, they account for around 8.2 percent of all the fishing vessels operating in the GFCM area of application (9.4 percent of just Mediterranean vessels) and

Main ports in terms of landings in the GFCM area of application

Port	Country	Landings (tonnes)	% contribution
Samsun Merkez B.B. (Black Sea)	Türkiye	31 039	2.6
Poti (Black Sea)	Georgia	23 035	1.9
Terme B.B. (Black Sea)	Türkiye	19 571	1.7
Izbet Elborg (Mediterranean)	Egypt	16 649	1.4
Chebba (Mediterranean)	Tunisia	16 423	1.4
Tirebolu B.B. (Black Sea)	Türkiye	15 997	1.4
Kandıra-Bağırganlı B.B. (Black Sea)	Türkiye	15 840	1.3
Hopa B.B. (Black Sea)	Türkiye	15 622	1.3
Teboulba (Mediterranean)	Tunisia	14 526	1.2
Port Saïd (Mediterranean)	Egypt	13 747	1.2

Note: % contribution indicates relative contributions of main ports to total landings in the GFCM area of application.

Main ports in terms of landings in the Mediterranean Sea

Port	Country	Landings (tonnes)	% contribution
Izbet Elborg	Egypt	16 649	2.2
Chebba	Tunisia	16 423	2.2
Teboulba	Tunisia	14 526	2.0
Port Saïd	Egypt	13 747	1.9
Ghazaouet	Algeria	11 476	1.5
Borg Elburullus	Egypt	10 588	1.4
Kélibia	Tunisia	10 376	1.4
Sfax	Tunisia	8 907	1.2
Chioggia	Italy	8 740	1.2
Zarzis	Tunisia	8 319	1.1

Note: % contribution indicates relative contribution of each main port to total landings in the Mediterranean Sea.

Main ports in terms of landings in the Black Sea

Port	Country	Landings (tonnes)	% contribution
Samsun Merkez B.B.	Türkiye	31 039	7.0
Poti	Georgia	23 035	5.2
Terme B.B.	Türkiye	19 571	4.4
Tirebolu B.B.	Türkiye	15 997	3.6
Kandıra-Bağırganlı B.B.	Türkiye	15 840	3.6
Hopa B.B.	Türkiye	15 622	3.5
Şile B.B.	Türkiye	12 660	2.9
Demirci Köyü B.B.	Türkiye	11 605	2.6
Inebolu Gemiciler B.B.	Türkiye	11 540	2.6
Iğneada B.B.	Türkiye	10 364	2.3

Note: % contribution indicates relative contributions of main ports to total landings in the Black Sea.

(Continued)

Box 9. (continued)

Main ports in terms of operating vessels in the Mediterranean Sea

Port	Country	Vessels
Chebba	Tunisia	995
Zarzis	Tunisia	906
Melita	Tunisia	791
Béni Nsar	Morocco	708
Houmet Souk	Tunisia	699
Al Hoceima	Morocco	671
Tanger Ville	Morocco	560
Sfax	Tunisia	550
Zuwarah	Libya	548
Misurata	Libya	543

Main ports in terms of operating vessels in the Black Sea

Port	Country	Vessels
Samsun Merkez B.B.	Türkiye	347
Demirci Köyü B.B.	Türkiye	250
Iğneada B.B.	Türkiye	207
Hopa B.B.	Türkiye	194
Tirebolu B.B.	Türkiye	192
Şile B.B.	Türkiye	180
Terme B.B.	Türkiye	170
Sozopol	Bulgaria	149
Kandıra-Bağırganlı B.B.	Türkiye	145
Giresun Merkez B.B.	Türkiye	140

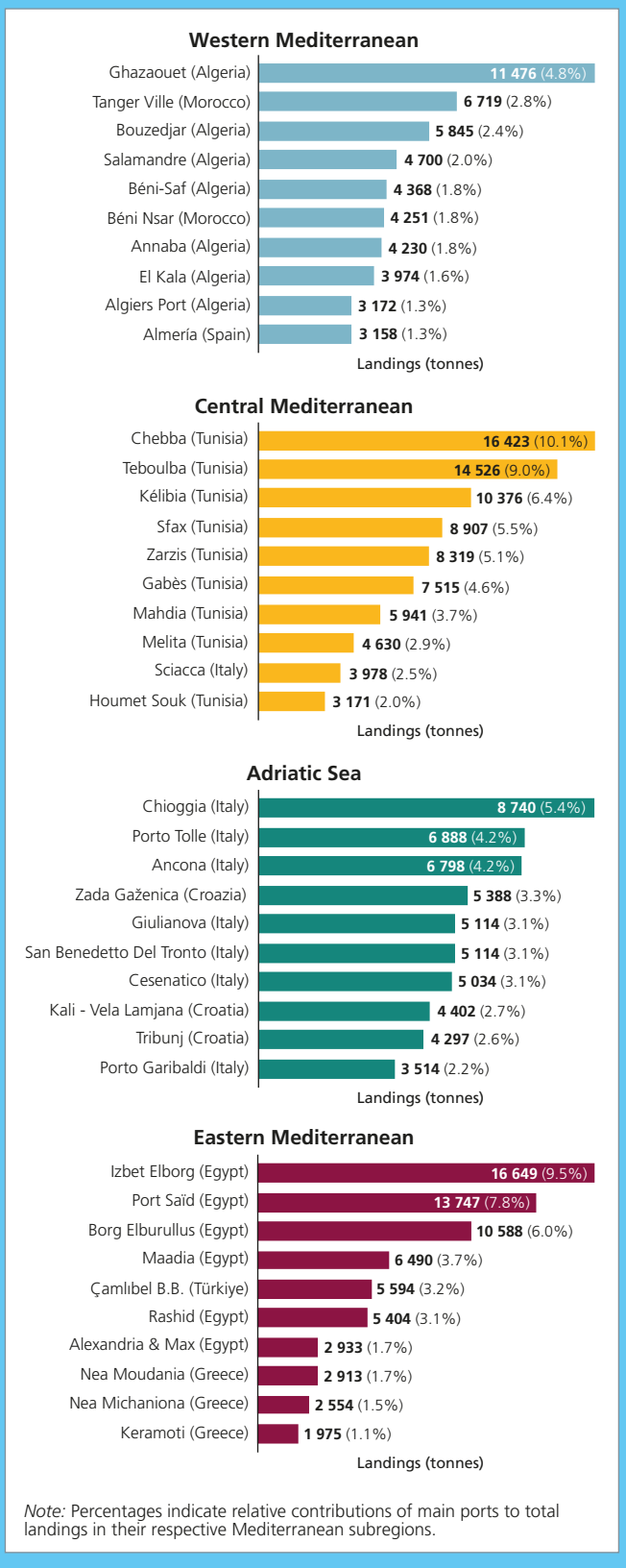
contribute 5.2 percent of the region's total landings (8.3 percent of just Mediterranean total landings).

In the Black Sea, nine out of the ten most important ports are located in Türkiye and one is in Bulgaria. They account for around 18 percent of the fishing vessels operating in the Black Sea and contribute 8.3 percent of the total landings.

Main ports in terms of volume of landings by Mediterranean subregion

In the western Mediterranean (Algeria, France, Morocco and Spain), the ten most important landing ports are located in Algeria (seven ports), Morocco

Main ports in terms of landings in each Mediterranean subregion



Note: Percentages indicate relative contributions of main ports to total landings in their respective Mediterranean subregions.

(Continued)

Box 9. (continued)

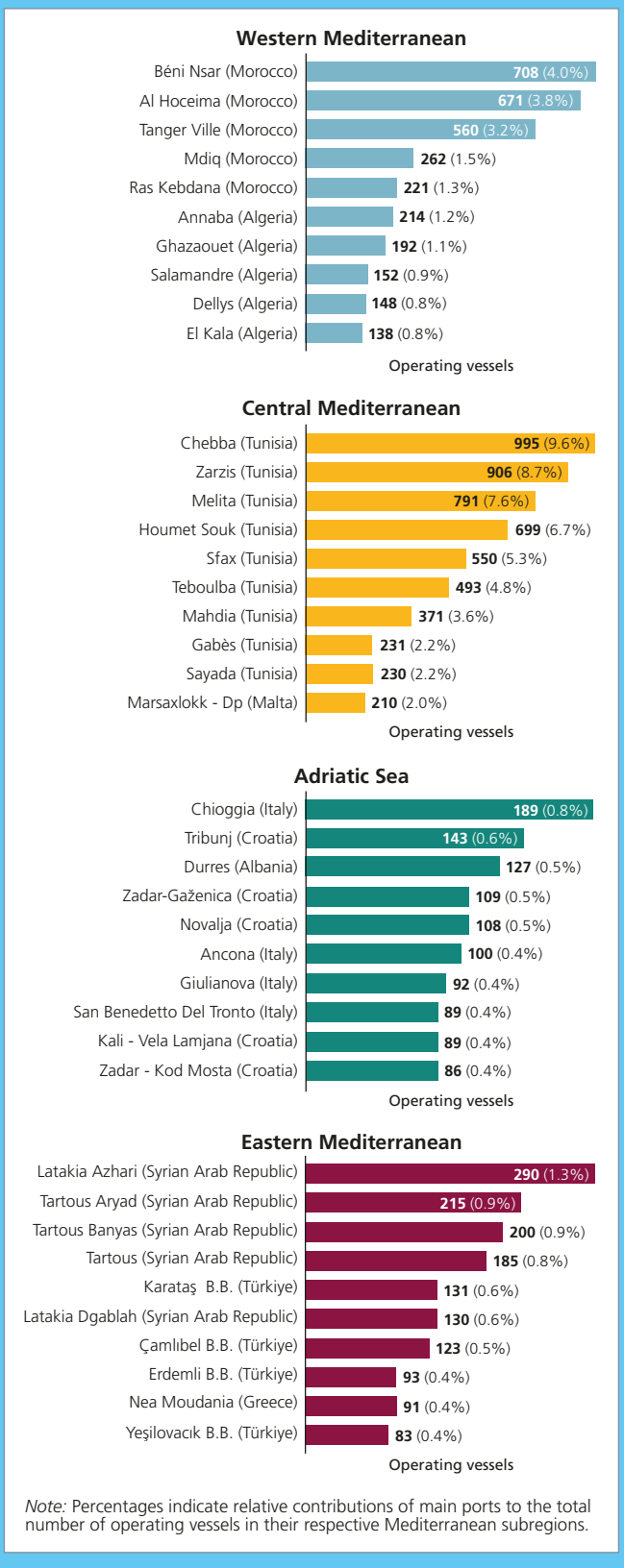
(two ports) and Spain (one port). In the central Mediterranean (Italy, Libya, Malta and Tunisia), the ten most important landing ports are in Tunisia (nine ports) and Italy (one port). In the eastern Mediterranean (Cyprus, Egypt, Greece, Israel, Syrian Arab Republic and Türkiye), the ten most important landing ports are in Egypt (six ports), Greece (three ports) and Türkiye (one port). In the Adriatic Sea (Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro and Slovenia), the ten most important landing ports are located in Italy (seven ports) and Croatia (three ports).

Main ports in terms of operating vessels by Mediterranean subregion

Different rankings of countries emerge for each GFCM subregion when they are based on analyses of the main landing ports by number of operating vessels instead of by landings.

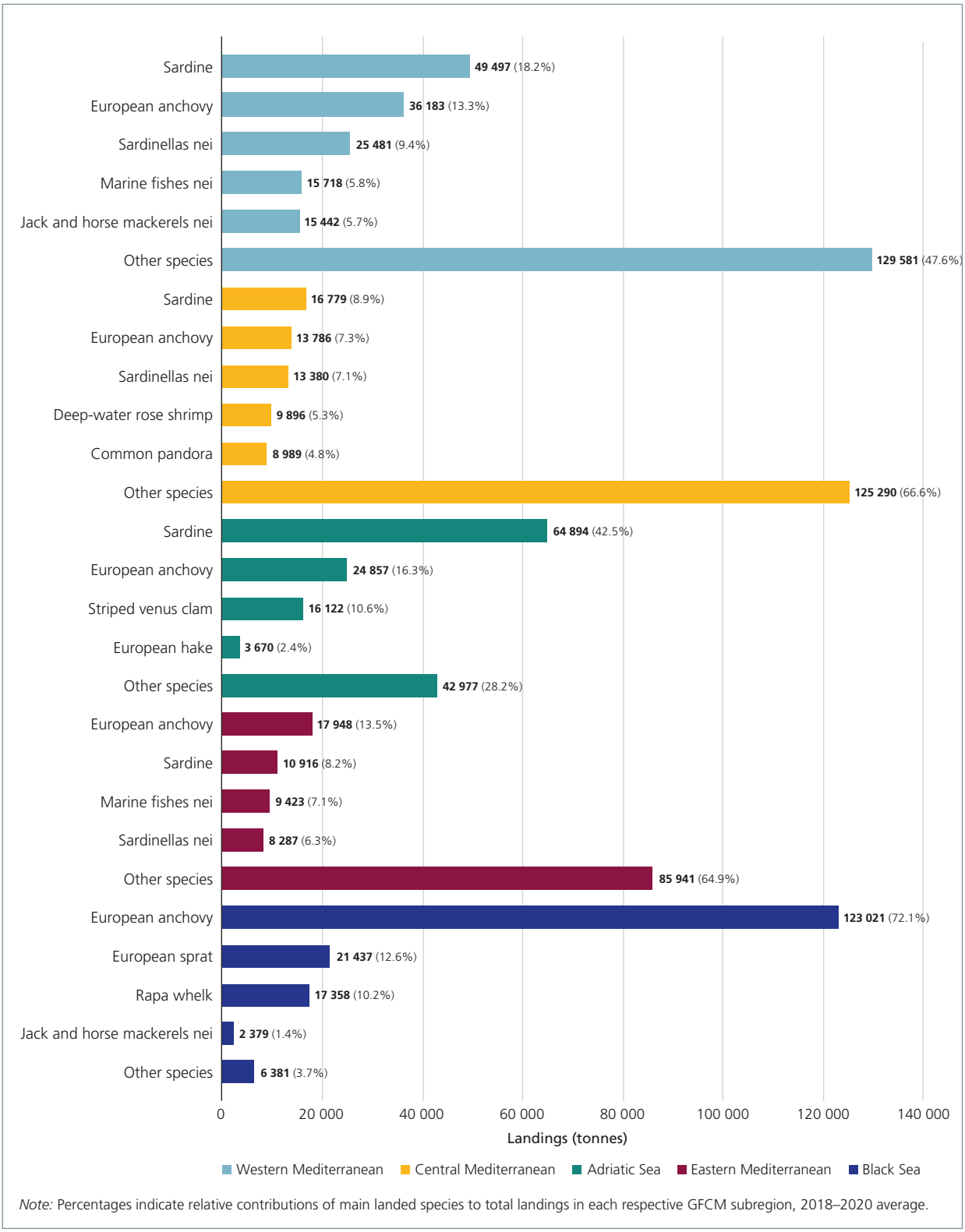
In the western Mediterranean, Spain is no longer represented among the ten most important ports, which are all located in Algeria and Morocco. In the central Mediterranean, Italy is likewise no longer represented among the ten most important ports, which are all located in Tunisia, except for one Maltese port. In the eastern Mediterranean, Egypt is no longer represented among the ten most important ports, which are in the Syrian Arab Republic (five ports), Türkiye (four ports) and Greece (one port). In the Adriatic Sea, Albania accounts for one of the ten most important ports, while the rest are located in Croatia (five ports) and Italy (four ports).

Main ports in terms of operating vessels in each Mediterranean subregion



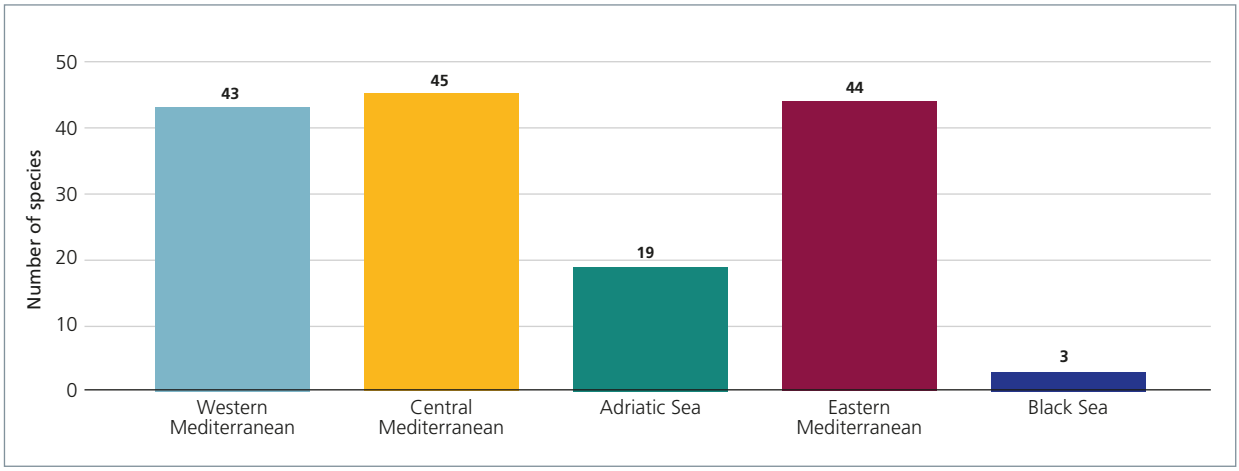
Note: Percentages indicate relative contributions of main ports to the total number of operating vessels in their respective Mediterranean subregions.

FIGURE 31. Average annual landings of the main landed species in each GFCM subregion, 2018–2020



Note: Percentages indicate relative contributions of main landed species to total landings in each respective GFCM subregion, 2018–2020 average.

FIGURE 32. Number of species or species groups accounting for 90 percent of the total catch of each GFCM subregion, 2018–2020



In the Black Sea, in addition to European anchovy, species of particular importance in terms of landings are European sprat (21 400 tonnes; 12.6 percent), rapa whelk (17 400 tonnes; 10.2 percent) and mackerels nei (2 400 tonnes; 1.4 percent), with all other species together contributing 3.7 percent of the total, with 6 400 tonnes (Figure 31).

Overall, the diversity of species in the catch is much higher in the central, eastern and western Mediterranean (roughly 44 species). In comparison, the lowest number of species that can be summed together to account for 90 percent of the total catch in the Adriatic and the Black Sea is smaller (slightly less than 20 for the Adriatic and less than five for the Black Sea) (Figure 32).

Box 10. The COVID-19 pandemic and its impacts on Mediterranean and Black Sea fisheries

The declaration of COVID-19 as a pandemic in March 2020 by the World Health Organization was followed by unprecedented impacts on the global economy. Sectors highly dependent on trade, including the fisheries sector, were particularly affected. Severe declines were observed in fisheries production, employment and prices, while fisheries research, management, monitoring, control and surveillance also suffered negative impacts.[1]

The Mediterranean and Black Sea region was not spared from the fallout of this global pandemic. In order to better understand its impacts on the sector, during the critical first months of the pandemic, the GFCM published two analyses. The first aimed to detail the impacts of early lockdown measures[2] and the next to assess the evolution of the situation a few months into the crisis.[3] The analyses carried out showed an initial dramatic reduction of operating vessels (up to 80 percent) and an initial decrease in production of around 75 percent. Fish market prices also decreased between 20 and 70 percent during this initial phase, particularly for species typically destined for the hotel, restaurant and catering sector or international trade.

Although these early dramatic impacts eased and the sector rebounded somewhat towards the end of 2020[3] and early 2021 with the introduction of policy responses and vaccination campaigns, the data presented in *The State of Mediterranean and Black Sea Fisheries 2022* – for which 2020 primarily serves as the reference year – confirm that the Mediterranean and Black Sea fishing sector did not emerge from the pandemic unscathed. Chapter 1 highlights declines in operating fishing vessels and fishing capacity in 2020, while Chapter 2 shows a drop in catch, both likely exacerbated by COVID-19 restrictions. In addition, Chapter 5 presents shifts in fishing pressure, which, although coherent with previously observed trends, may have also been affected by the reduction in fishing activities due to the pandemic.

The COVID-19 pandemic had cumulative impacts on revenue, employment and trade in fisheries products. Furthermore, the pandemic brought to light the essential role of social protection programmes to support the resilience of the fisheries sector and enable it to weather crises. Chapter 3 shows available information on the overall deterioration of income and employment within the sector, most likely aggravated by the COVID-19 pandemic, while both Chapter 3 and Chapter 6 highlight some of the measures taken by countries to alleviate its impacts on livelihoods in the region, particularly for small-scale fishers.

[1] **FAO.** 2022. *The State of World Fisheries and Aquaculture 2022*. Towards Blue Transformation. Rome. https://doi.org/10.4060/cc0461en

[2] **GFCM.** 2020a. *Fisheries and aquaculture in the Mediterranean and the Black Sea: A preliminary analysis of the impacts of the COVID-19 crisis*. Rome, FAO. https://doi.org/10.4060/ca9090en

[3] **GFCM.** 2020b. *Fisheries and aquaculture in the Mediterranean and the Black Sea: An updated analysis of the impacts of the COVID-19 crisis*. Rome, FAO. https://doi.org/10.4060/ca9902en

3. Socioeconomic characteristics

The long-term sustainability of Mediterranean and Black Sea fisheries rests on the development of policies and strategies for the sector's management that are based on sound scientific advice. Recognizing that fisheries contribute significantly to livelihoods and the food security of coastal populations in the Mediterranean and Black Sea region, evidence-based fisheries management must consider the socioeconomic dynamics of the sector (Box 11). The regular collection and transmission of socioeconomic data by GFCM contracting parties and cooperating non-contracting parties (CPCs) to the GFCM support the analysis of the social and economic performance of the sector (e.g. revenue, gross value added, employment, remuneration), as well as the development of time series analyses of landing values and average prices for commercial species and analyses of the profitability and costs of different fleet segment groups. In turn, this analysis supports the appraisal of potential social and economic implications of fisheries management decisions, while also fitting a more accurate consideration of the fisheries sector within a wider vision for the region's blue transformation.

This chapter provides an overview of the latest information available on the economic performance and socioeconomic characteristics of capture fisheries in the Mediterranean and the Black Sea. A regional overview is presented first, providing a detailed analysis of revenue and employment at the regional, subregional and national levels, as well as by fleet segment group. Further analyses 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 follow. Particular focus is given to analyses by subregion and fleet segment group. Finally, a dedicated box provides insight into efforts to integrate socioeconomic information into management plans for select species (Box 11).

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 socioeconomic 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 2). The analysis presented in this chapter benefits from the higher quality and completeness of Task VI data submissions by CPCs, who have made concerted efforts in recent years to improve socioeconomic data collection, including through participation in GFCM socioeconomic surveys. The trade data used in this chapter are from the FAO Global fish trade database (FAO, 2022c). Specific data are also presented for select species under management, based on ad hoc data collection programmes and available national data. All monetary values listed in this chapter have been adjusted for inflation and are listed as constant 2020 USD to facilitate comparison across reference years (World Bank, 2022a, 2022b).

The reference year for all analyses was 2020, with some exceptions where data were unavailable, incomplete or inconsistent for this year. In order to allow for the analysis of specific indicators at the regional (GFCM area of application) and subregional (western Mediterranean, central Mediterranean, Adriatic Sea, eastern Mediterranean and Black Sea) levels (see Figure 1), some data from previous years were considered to complete the datasets.[6, 7] Moreover, due to limited data availability, Georgia was only considered in the regional overview focusing on total employment and total revenues (at first sale)[8] and was not considered in the analysis of more specific socioeconomic indicators by subregion. Finally, data for Bosnia and Herzegovina, Israel, Libya and the Syrian Arab Republic, as well as for the Russian Federation and Palestine, were not reported in any of the analyses within the present chapter on socioeconomics due to a lack of availability.

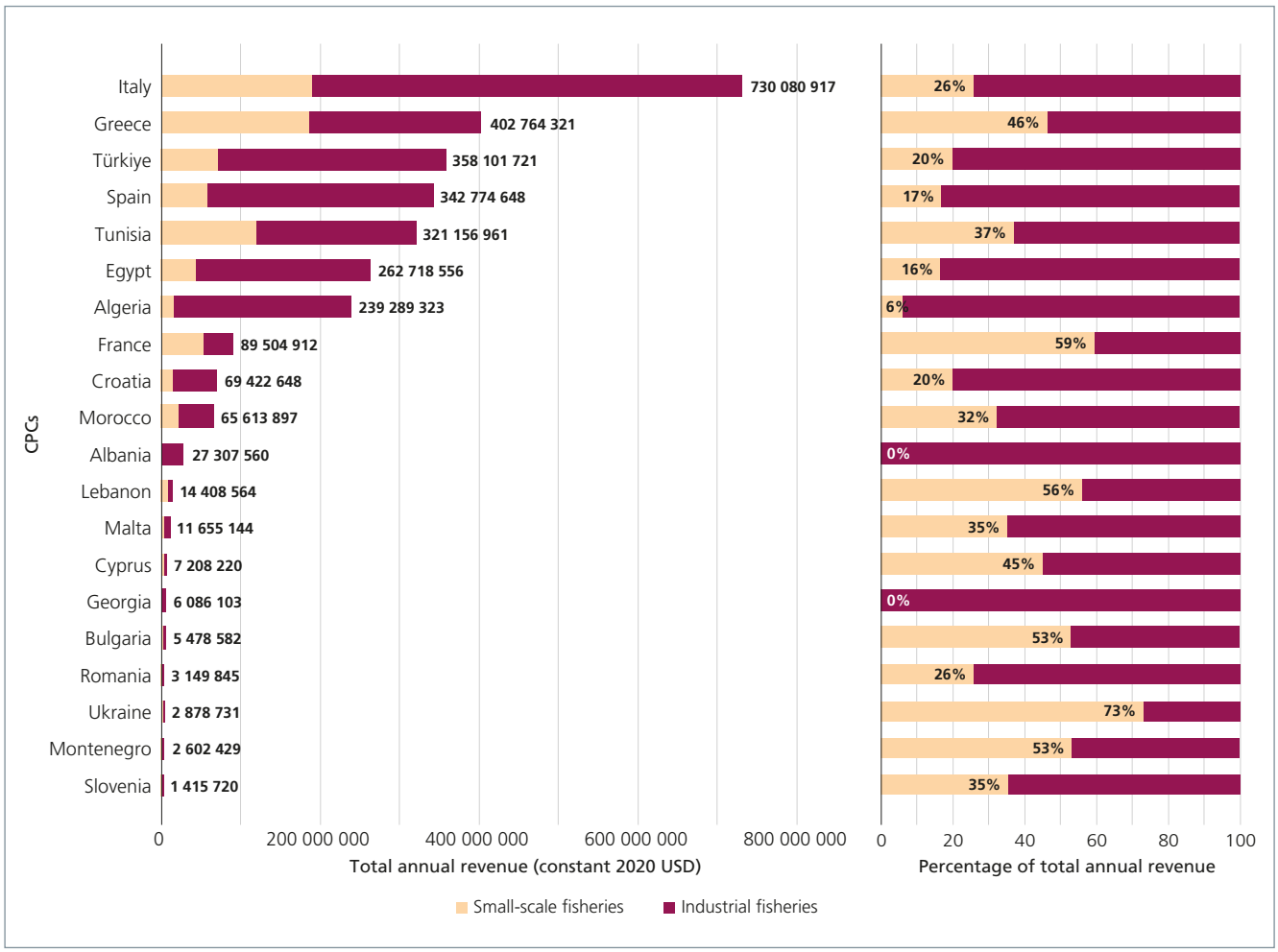
Specific analyses by fleet segment group make reference to the fleet segment groups outlined in Table 6, namely: small-scale vessels; trawlers and beam trawlers; purse seiners and pelagic trawlers; and other fleet segments. However, to better analyse the economic characteristics of these groups, particularly 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". Additionally, as noted in Chapter 1, the aggregation of fleet segments included within the group "Small-scale vessels" that first appeared in *The State of Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a) differs from the previous editions (FAO, 2016, 2018) in order to reflect the conclusions of the second meeting of the Working Group on Small-Scale Fisheries (GFCM, 2019). Furthermore, to support some analyses, small-scale fisheries (SSF) refers to the "Small-scale vessels" fleet segment group, whereas all other fleet segment groups are collectively referred to as industrial fisheries.

[6] Reference years are as follows: 2020 for Algeria, Bulgaria, Croatia, Cyprus, France, Greece, Italy, Malta, Morocco, Romania, Slovenia and Türkiye; 2019 for Montenegro and Spain; 2018, as previously published in FAO (2020a), for Albania, Egypt, Lebanon, Tunisia and Ukraine.

[7] Data presented for Ukraine refers to 2018 and as such does not include the impact of the conflict between Ukraine and the Russian Federation. A preliminary analysis of the impact of this conflict on the fisheries and aquaculture sector was carried out and reported in *The State of World Fisheries and Aquaculture 2022* (FAO, 2022b, p.223).

[8] Data sources for Georgia are from FAO (2020a), with 2016 as reference year.

FIGURE 33. Revenue from marine capture fisheries by GFCM contracting party and cooperating non-contracting party



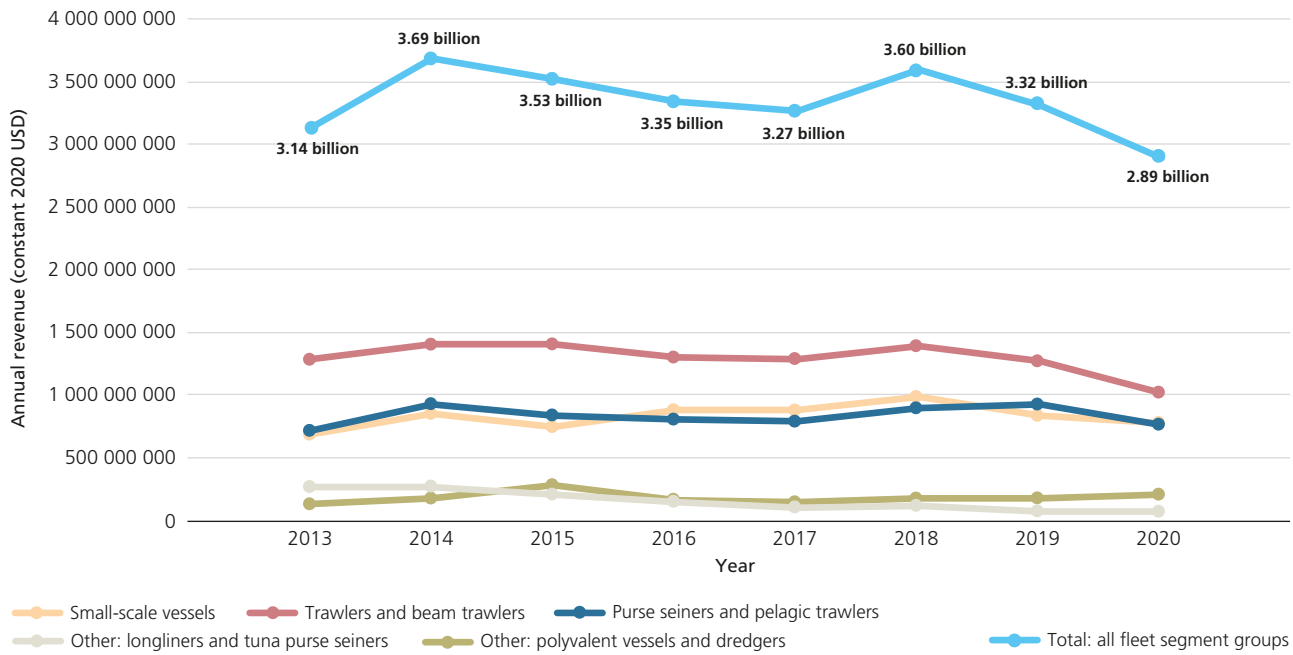
REGIONAL SOCIOECONOMIC REVIEW

The total revenue from marine capture fisheries in 2020 in the GFCM area of application is estimated to be USD 2.9 billion (USD 2.7 billion in the Mediterranean and USD 241 million in the Black Sea). 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. Seven countries, namely Italy, Greece, Türkiye, Spain, Tunisia, Egypt and Algeria, account for approximately 90 percent of the total revenue (Figure 33).

However, as the wider economic impact of fisheries along the value chain in the region, including direct, indirect and induced effects, is estimated at 2.6 times the value at first sale (FAO, 2020a), or approximately USD 7.7 billion, then even in countries where the value at first sale may be relatively lower, the impact of the fishing sector on the economy can still be significant.

It is notable that the revenue from fisheries in 2020 is estimated to have declined by almost USD 700 million since 2018 (the reference year for the previous edition of *The State of Mediterranean and Black Sea Fisheries* [FAO, 2020a]). This decline in revenue

FIGURE 34. Revenue from marine capture fisheries per year by fleet segment group in the GFCM area of application, 2013–2020



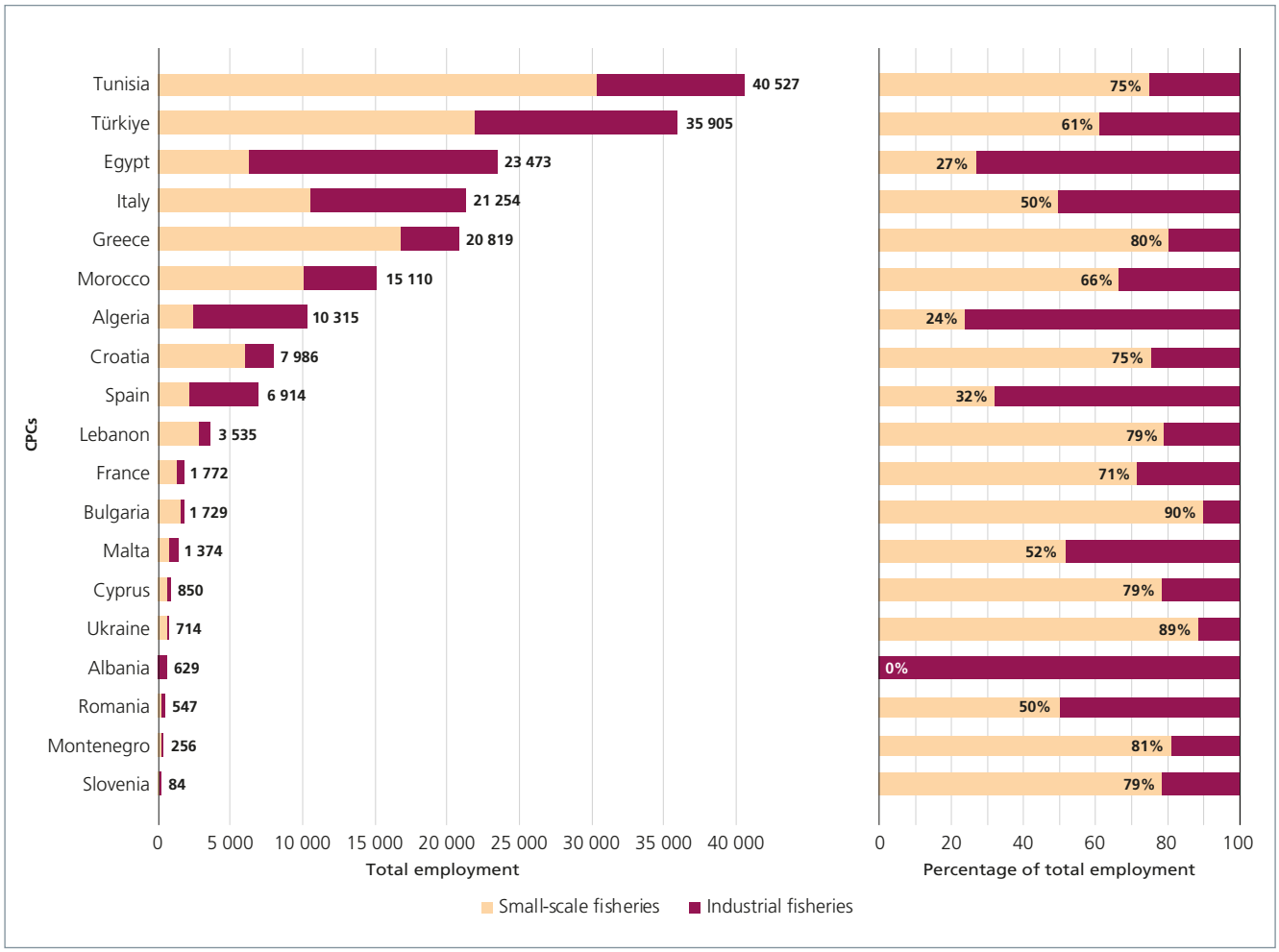
may partly result from the important impacts of the COVID-19 pandemic on the region's capture fisheries sector, which initially included restrictions on trade and marketing of fish products and price volatility for some fish species. A reconstruction of revenue (adjusted for inflation and calculated as constant 2020 USD) from 2013 to 2020, however, shows that total revenue has fluctuated between USD 2.9 and 3.7 billion over this period (Figure 34), and revenue was already beginning to decline in 2019.

Small-scale fisheries contribute 27 percent of the total revenue in the GFCM area of application (28 percent in the Mediterranean and 15 percent in the Black Sea). Considering the revised calculation of the small-scale vessels fleet segment group, this represents a decline of 2 percent compared with the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a). However, revenue from SSF can vary widely between countries. In five countries – namely Bulgaria, France, Lebanon, Montenegro and Ukraine – SSF contribute over 50 percent of the total revenue from marine capture fisheries (reaching as high as 73 percent in some countries) (Figure 33).

Total employment on board fishing vessels (part-time and full-time included) in the GFCM area of application[9] is 194 000 (166 000 in the Mediterranean and 28 000 in the Black Sea) (Figure 35). Six countries, namely Tunisia, Türkiye, Egypt, Italy, Greece and Morocco, account for approximately 81 percent of total employment. Compared to the last figure for reference year 2018 (225 000 total, of which 202 000 came from the Mediterranean and 23 000 from the Black Sea; FAO, 2020a), this value indicates a decrease of approximately 18 percent employment in the Mediterranean, but an increase of around 22 percent in the Black Sea. These fluctuations in employment figures may result, in part, from the diverse restrictions put

[9] 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).

FIGURE 35. Employment on board small-scale and industrial fishing vessels by GFCM contracting party and cooperating non-contracting party

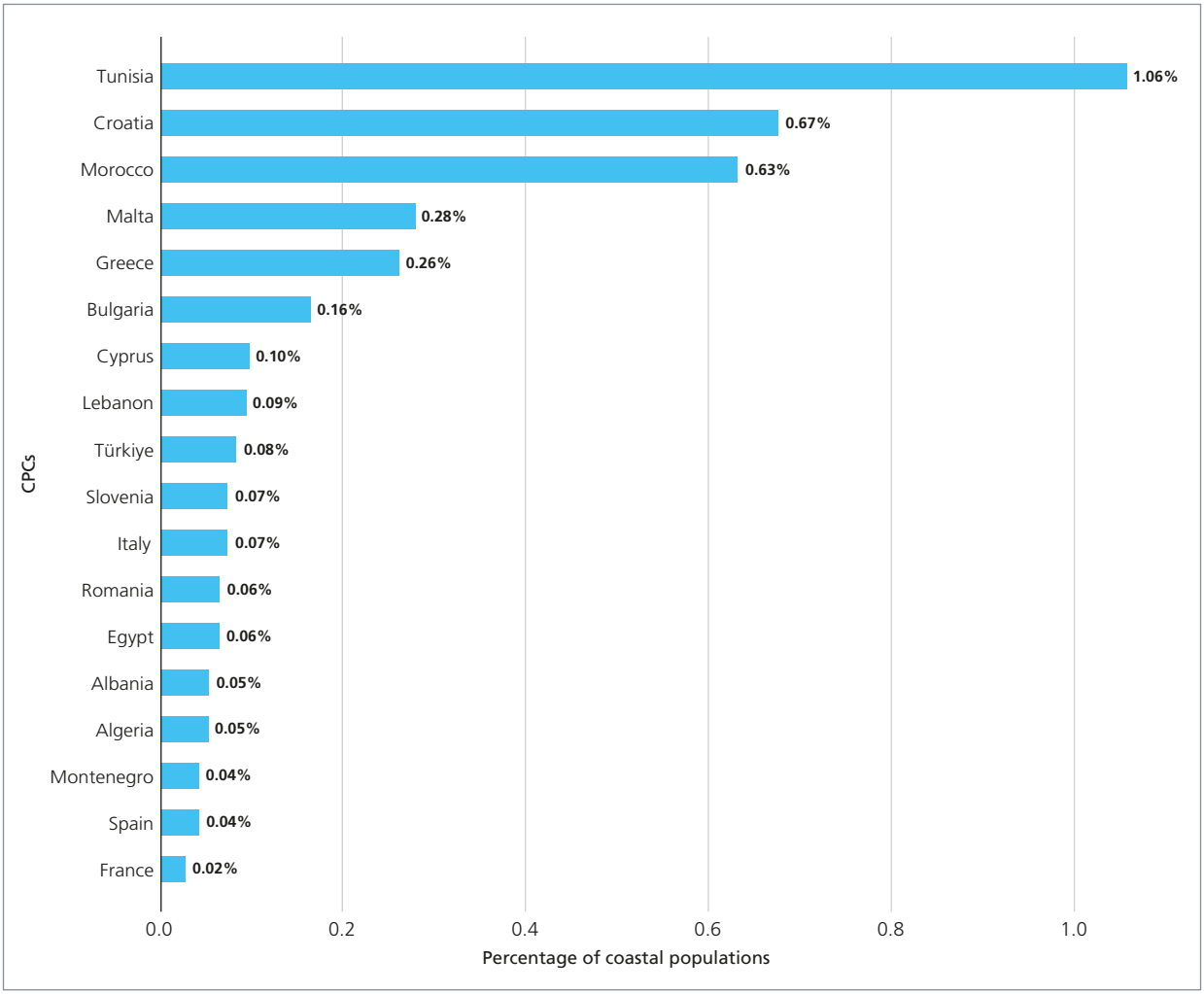


in place by countries during the COVID-19 pandemic in 2020, which varied widely as countries grappled with the need to apply social distance measures to curb the spread of the pandemic while ensuring that livelihoods and food security were supported (FAO, 2020a).

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 other shore-based activities, as well as the frequently "invisible" work of women (FAO, 2017; 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 on board vessels (World Bank, 2012), meaning that the total employment in the fisheries sector in the GFCM area of application is estimated at just under a half a million people.

Regardless of a decline in total employment on board fishing vessels, fisheries in the region continue to provide jobs where they are needed most, namely in rural coastal communities. On average, employment on board fishing vessels represents approximately 0.1 percent of total coastal populations (i.e. approximately one fisher per every 1 000 coastal residents) and in some countries, such as Tunisia, Croatia and Morocco, this figure can reach as high as 0.6 to 1.1 percent (i.e. approximately one fisher every 95 to 200 coastal residents) (Figure 36).

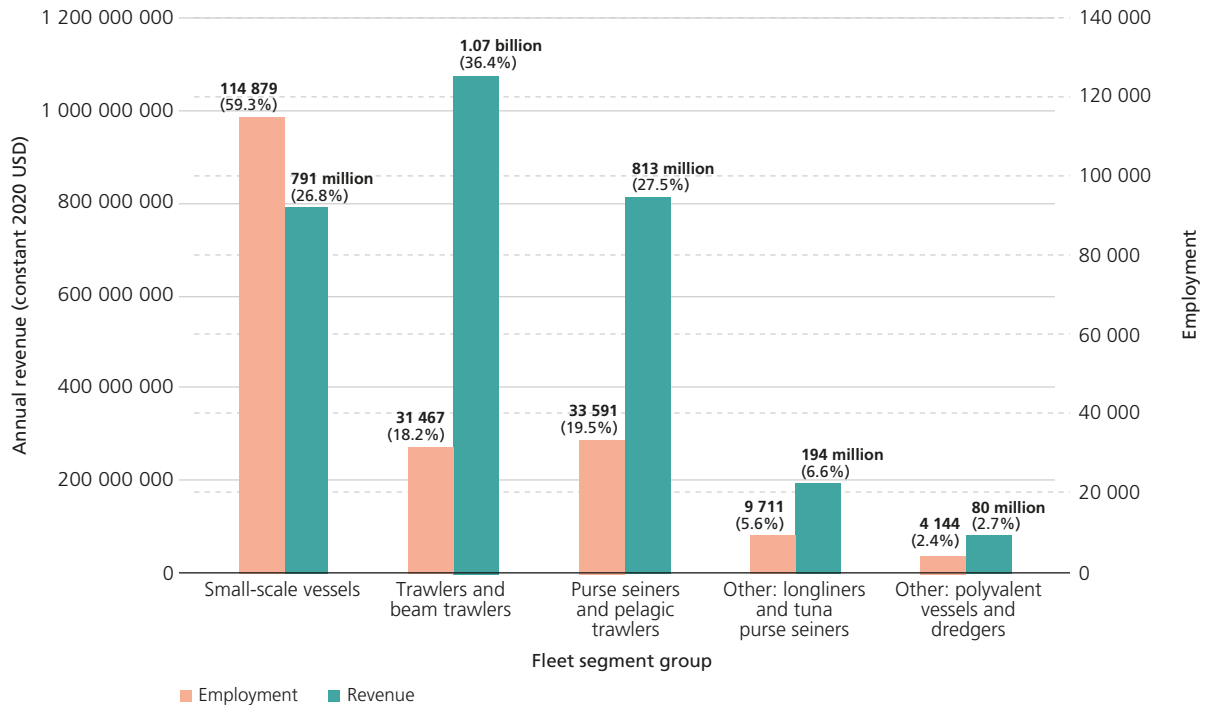
FIGURE 36. Percentage of coastal populations employed on board fishing vessels by GFCM contracting party and cooperating non-contracting party



At the regional level, SSF contribute 59 percent of total employment on board fishing vessels (60 percent in the Mediterranean and 58 percent in the Black Sea). This value represents a 2 percent increase from the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a). In four countries, namely Bulgaria, Ukraine, Montenegro and Greece, SSF account for over 80 percent of the total employment (Figure 35).

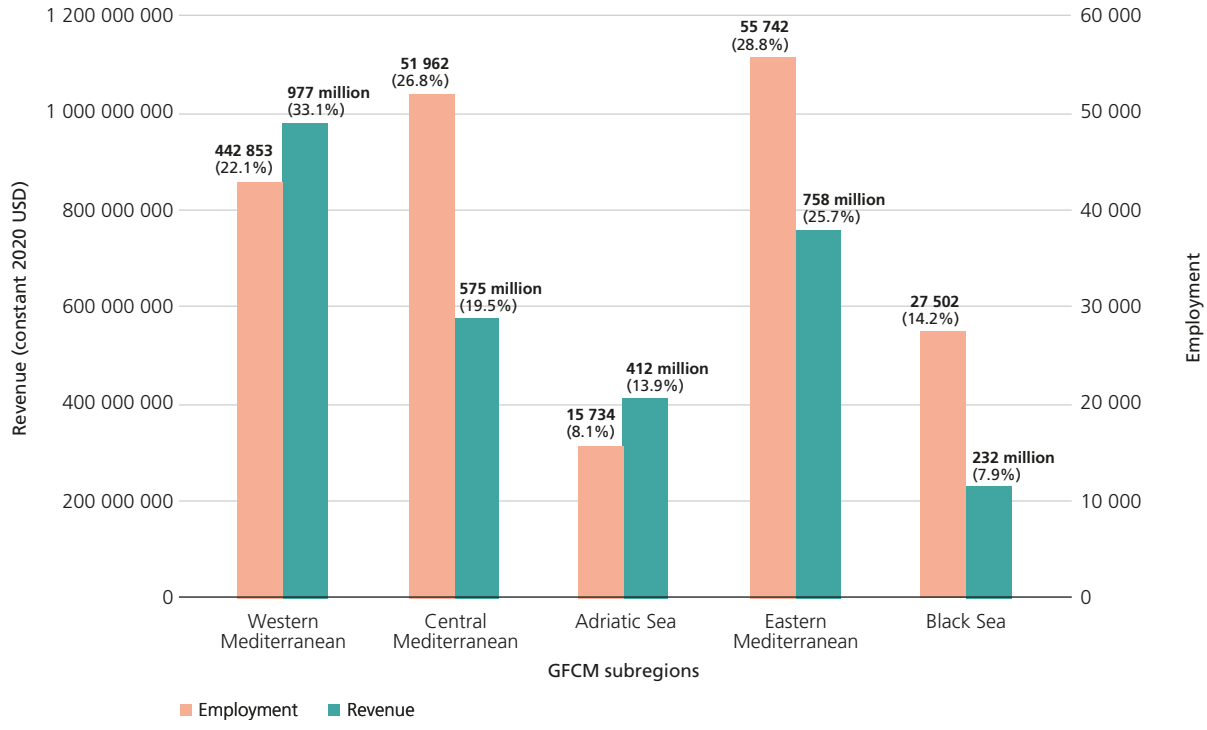
As shown in Figure 33 and Figure 35, benefits from fisheries are not equally distributed between SSF and industrial fisheries. While SSF generate 59 percent of total employment, they account for only 27 percent of total revenue, on average, in the region. On the other hand, while only 40 percent of people employed in fisheries work on board industrial vessels, the industrial fishing sector captures 73 percent of the total revenue of the sector (broken down into 36.4 percent from trawlers and beam trawlers, 27.5 percent from purse seiners and pelagic trawlers, 6.6 percent from longliners and tuna purse seiners, and 2.7 percent from polyvalent vessels and dredgers) (Figure 37).

FIGURE 37. Comparison of revenue and employment by fleet segment group in the GFCM area of application



Note: Percentages indicate the relative contributions of fleet segment groups to revenue and employment totals in the GFCM area of application.

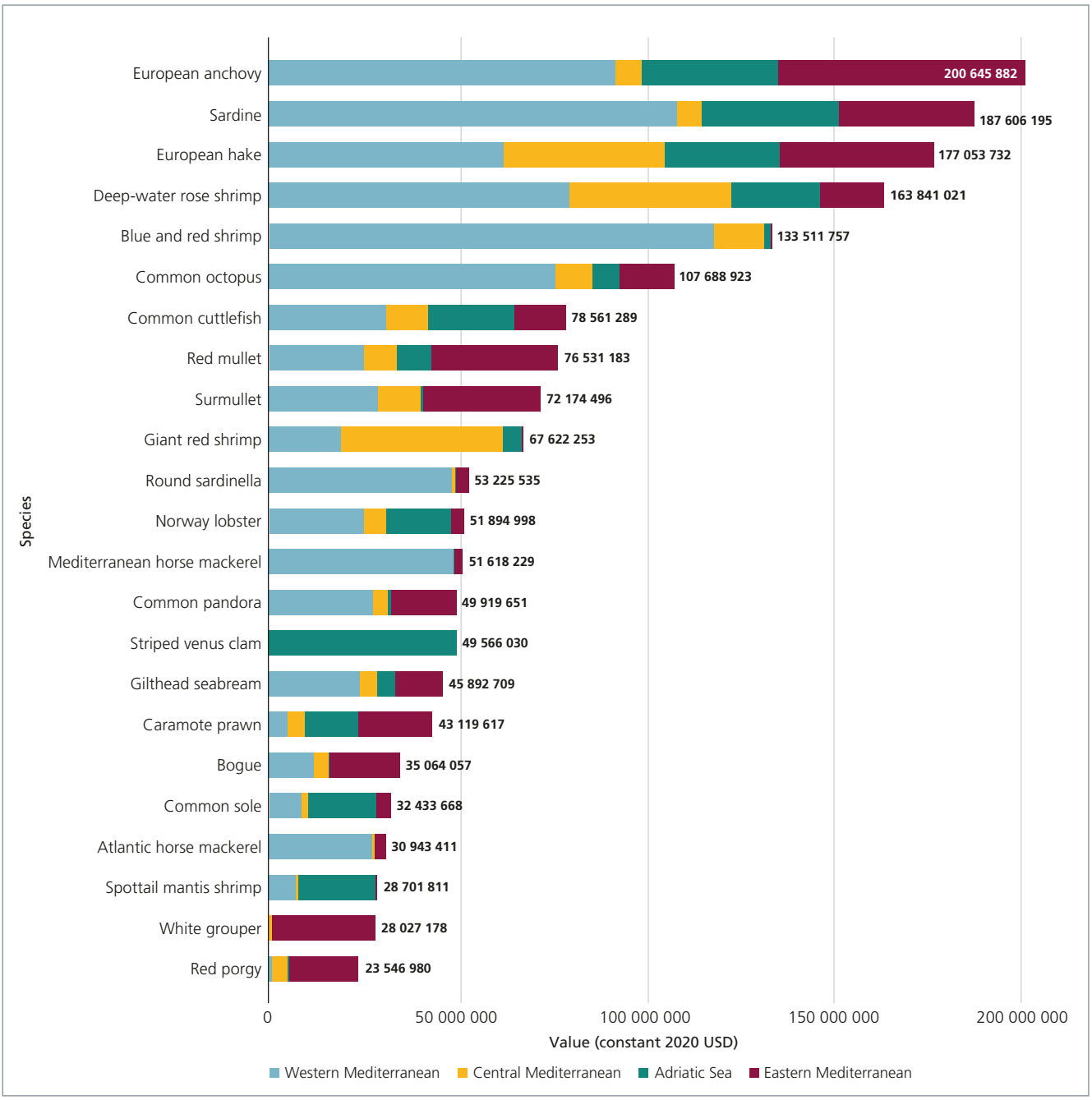
FIGURE 38. Comparison of revenue and employment by GFCM subregion



Note: Percentages indicate the relative contributions of GFCM subregions to revenue and employment totals in the GFCM area of application.

At the subregional level, benefits are more evenly distributed (Figure 38), with the eastern Mediterranean accounting for 32.3 percent of employment and 25.7 percent of revenue, followed by the central Mediterranean (26.8 percent of employment and 19.5 percent of revenue), the western Mediterranean (24.8 percent of employment and 33.1 percent of revenue), the Adriatic Sea (9.1 percent of employment and 13.9 percent of revenue) and the Black Sea (15.9 percent of employment and 7.9 percent of revenue). Deeper examination of these figures by fleet segment group are presented in the sections of this chapter on "Economic performance of the fishing fleet" and "The contribution of fisheries to livelihoods".

FIGURE 39. Main commercial species (in terms of value) in the Mediterranean subregions



SPECIES OF COMMERCIAL IMPORTANCE IN THE GFCM AREA OF APPLICATION

While Mediterranean and Black Sea fisheries are predominantly multi-species fisheries, 23 species represent almost 75 percent of the total landing value at first sale in the Mediterranean (Figure 39) and just 14 species represent almost 97 percent of the total landing value in the Black Sea (Figure 40). These values are based on DCRF Task VI.3 data submissions; where unavailable, values were reconstructed 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 database. At the regional level (both Mediterranean and Black Sea), the species of greatest importance, in terms of total landing value, are European anchovy (*Engraulis encrasicolus*; USD 296 million), sardine (*Sardina pilchardus*; USD 188 million), European hake (*Merluccius merluccius*; USD 177 million), deep-water rose shrimp (*Parapenaeus longirostris*; USD 167 million), blue and red shrimp (*Aristeus antennatus*; USD 134 million) and common octopus (*Octopus vulgaris*; USD 108 million), together accounting for just over 40 percent of the total landing value in the region.

There is considerable variation among the main species of commercial importance by fleet segment group and subregion (Figure 41). For example, for SSF, the species of greatest commercial importance by subregion are: common octopus in the western Mediterranean, European hake in the central Mediterranean, common cuttlefish (*Sepia officinalis*) in the Adriatic Sea, surmullet (*Mullus surmuletus*) in the eastern Mediterranean and Atlantic bonito (*Sarda sarda*) in the Black Sea. Considering the important role of SSF in generating livelihoods in the region (the sector accounts for approximately 59 percent of onboard employment – see page 50), the proper management of these species is crucial to supporting fisheries-based livelihoods.

FIGURE 40. Main commercial species (in terms of value) in the Black Sea

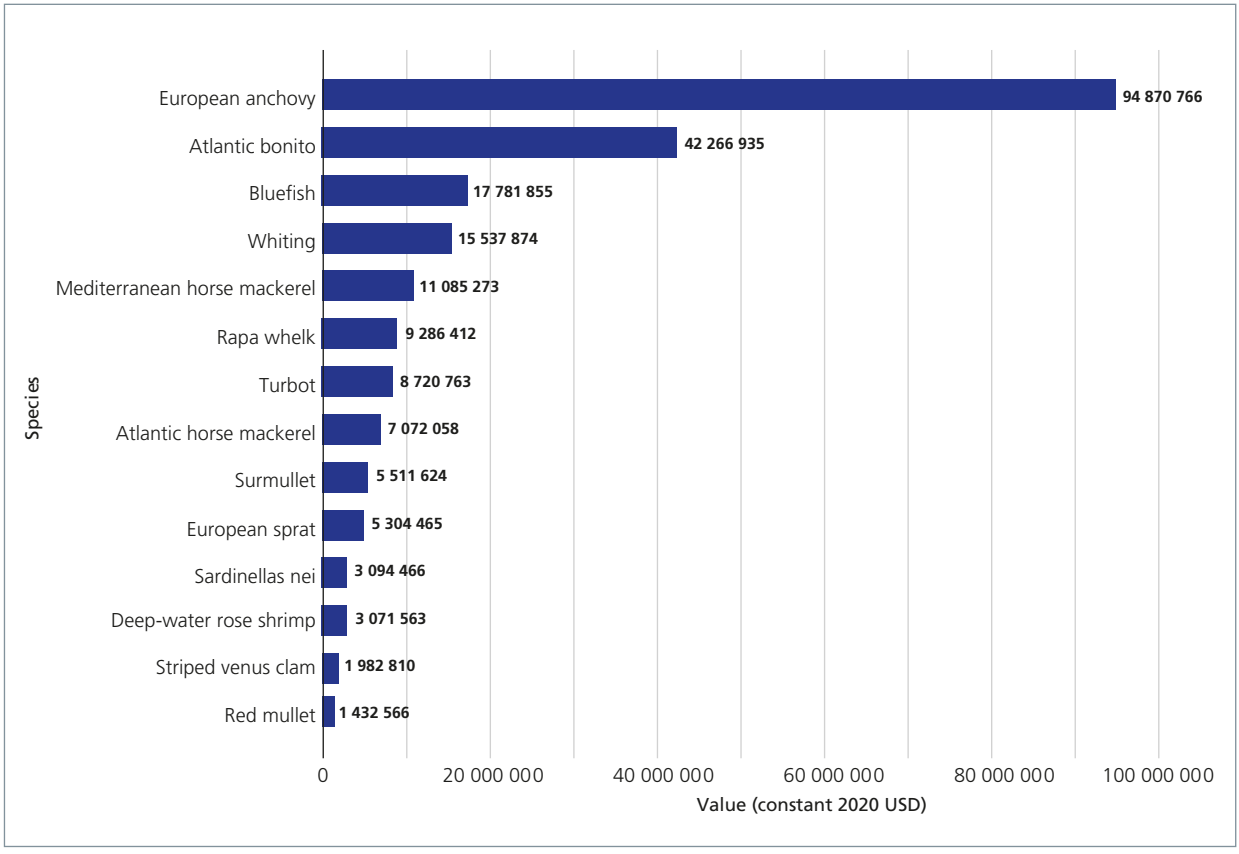


FIGURE 41. Top five commercial species (in terms of value) by fleet segment group in the Mediterranean subregions and in the Black Sea

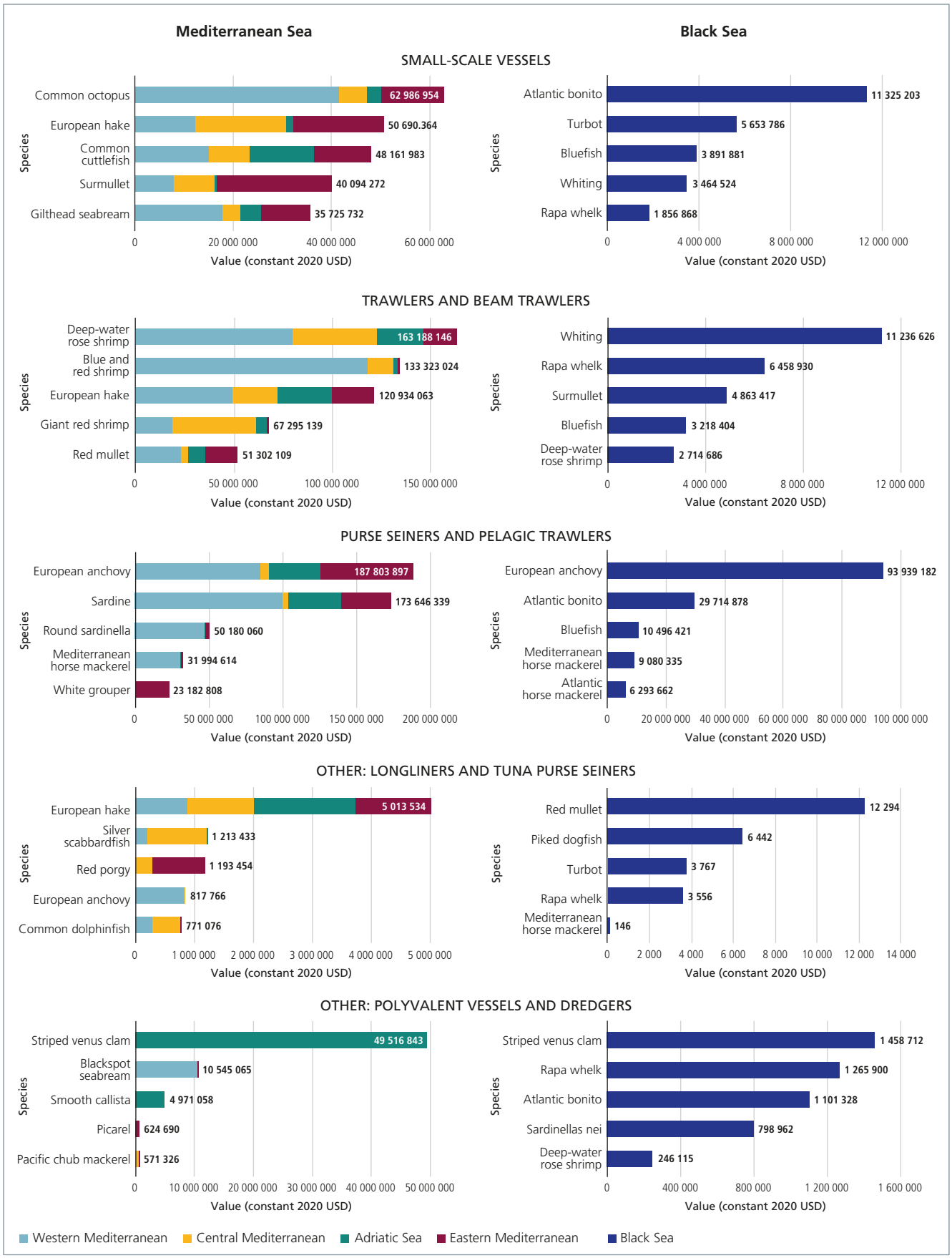
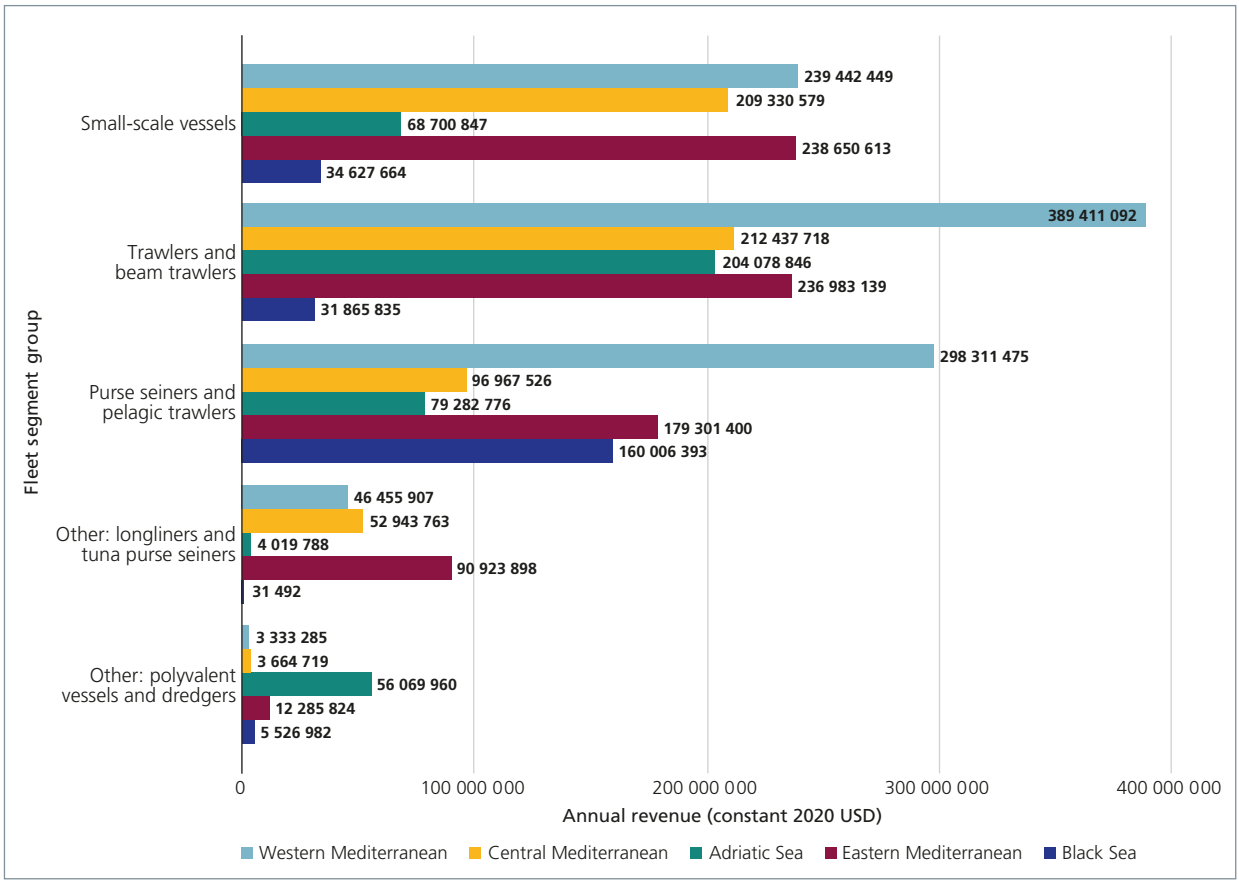


FIGURE 42. Revenue from marine capture fisheries by fleet segment group and GFCM subregion



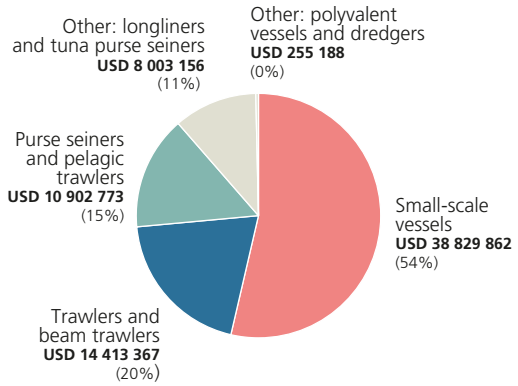
ECONOMIC PERFORMANCE OF THE FISHING FLEET

Revenue

The beginning of this chapter provided a regional snapshot of revenue from marine capture fisheries by fleet segment group and by GFCM subregion, particularly in Figure 37 and Figure 38. However, further examination of revenue at the subregional and fleet segment levels reveals how the relative importance, in terms of revenue, of each of the different fleet segment groups can vary widely from one subregion to another (Figure 42). Trawlers and beam trawlers represent the greatest source of revenue in the western Mediterranean (39.9 percent) and in the Adriatic Sea (49.5 percent). On the other hand, in the central Mediterranean and the eastern Mediterranean, small-scale vessels are equally important as trawlers and beam trawlers in terms of their capacity to generate revenue. In the central Mediterranean, small-scale vessels generate 36.4 percent of revenue in the subregion and trawlers and beam trawlers generate 36.9 percent, whereas in the eastern Mediterranean, small-scale vessels generate 31.5 percent of revenue and trawlers and beam trawlers generate 31.3 percent. In contrast, in the Black Sea, purse seiners and pelagic trawlers represent the greatest source of revenue (69 percent). While the revenue generated by the "Other" fleet segment groups is small in comparison, the relative importance of the "Other: longliners and tuna purse seiners" fleet segment group in the eastern Mediterranean, as well as of the "Other: polyvalent vessels and dredgers" in the Adriatic Sea, is noteworthy.

According to data reported via the DCRF, while the primary source of revenue for all fishing vessels in the region is commercial fishing activity, approximately USD 72 million (2.4 percent of revenue in the region) is generated from using the regional fleet for other activities. These revenue sources can include the use of vessels for tourism or recreational activities (e.g. pescatourism), vessel rentals for use as support boats for aquaculture activities or marine extraction industries (e.g. oil, gas) and income that may be generated from leasing quotas or fishing rights. The majority of

FIGURE 43. Other income from vessel use by fleet segment group



Note: Percentages indicate relative contributions of fleet segment groups to total other income from vessel use in the GFCM area of application.

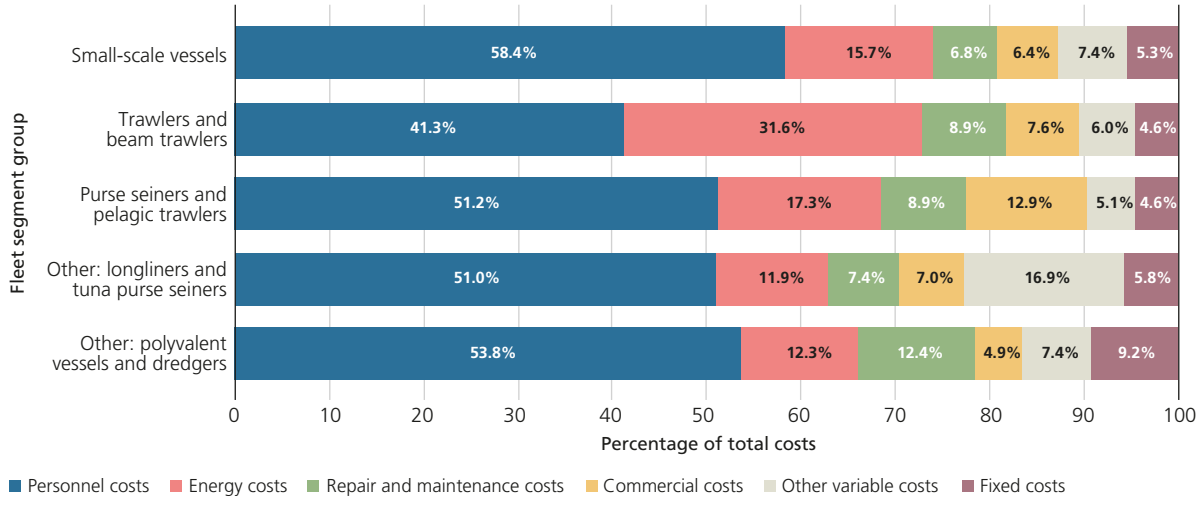
this additional income is generated by small-scale vessels (54 percent), underlining the importance of livelihood diversification activities for this fleet segment group (Figure 43).

Operating costs

An analysis of operating costs provides insight into both the variable and fixed costs necessary to carry out fishing activities. These costs include personnel costs (crew remuneration, social security costs, etc.); energy costs (consumed fuel, lubricants for the vessel, etc.); repair and maintenance costs (of fishing equipment, gear, vessel parts, etc.); commercial costs (fish market or wholesaler fees, materials to market the catch, including the purchase of ice, boxes and packaging, etc.); other variable costs (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 bank expenses, annual quota for fisher associations, dock expenses, renewal of fishing licences, etc.). Improved data submissions via the DCRF platform have, in recent years, facilitated an enhanced analysis of the cost structures of the regional fleet, starting with the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a).

In general, personnel costs, followed by energy costs, represent the most significant portion of operating costs, accounting for 49.8 percent and 21.4 percent of total costs, respectively. Cost structures, however, vary at the fleet segment group level (Figure 44), with personnel costs being particularly significant for small-scale vessels (58.4 percent of total costs) while energy costs represent only 15.7 percent of total small-scale vessel costs. On the other hand, the energy costs for trawlers and beam trawlers are relatively high compared to other fleet segment groups (31.6 percent of all operating costs) and

FIGURE 44. Operating cost structure (as a percentage of the total costs) by fleet segment group



personnel costs are relatively low (41.3 percent of all operating costs). Compared with other fleet segment groups, purse seiners and pelagic trawlers have relatively higher commercial costs (12.9 percent of all operating costs), in part reflecting the fact that species targeted by this fleet segment group are commonly destined for post-harvest processing. Furthermore, other variable costs are more significant for longliners and tuna purse seiners (16.8 percent), reflecting the use of bait by this fleet segment group.

Profitability and wealth generation

To gain insight into the profitability of the fishing sector, it is important to consider revenue and operating costs together. Gross cash flow (GCF) – calculated as revenue minus operating costs – reveals the total amount of cash generated each year by a fishing activity, thus assessing its feasibility of survival over the short term. Gross cash flow for all fleet segment groups continues to be positive, representing, on average, 24 percent of revenue. A positive GCF indicates that revenues from landings are greater than the total gross costs and that, on average, the fishing fleet in the region is profitable. Nevertheless, it is notable that GCF as a percentage of total annual revenue (Figure 45) decreased by between 1 and 8 percent for all industrial fleet segment groups in 2020 compared with 2018 (FAO, 2020a). On the other hand, GCF for small-scale vessels increased by 3 percent, perhaps reflecting the capacity of this group to adapt more readily to the changing circumstances posed by the COVID-19 pandemic. Despite this adaptability, small-scale vessels remain the fleet segment group with the lowest profit margins – with GCF representing 17 percent of total annual revenue, as compared with 27 percent for industrial fleet segment groups – hindering the SSF sector's ability to invest in itself over the long term (e.g. for gear or marketing improvements).

In addition to evaluating the profitability of fishing activity in the region, it is also useful to understand the wealth generated by the fishing sector. Fisheries are an important source of livelihoods in the region, and gross value added (GVA) – calculated as revenue minus all operating costs excluding personnel costs – provides an indicator of economic welfare generated by the sector by considering personnel costs as a positive contribution to the economy. Gross value added measures the contribution to gross domestic product by fishing activity.

The total GVA from fishing in the GFCM area of application in 2020 has been estimated at USD 1.7 billion, putting the GVA (for all fleet segment groups) as a percentage of revenue at approximately 60 percent. The GVA as a percentage of revenue for the small-scale vessel group is relatively high (66.3 percent), underlining the role this group plays in providing livelihoods for many people and serving as an important generator of wealth for the fishing sector.

FIGURE 45. Gross cash flow and operating cost structure (as a percentage of the total annual revenue) by fleet segment group

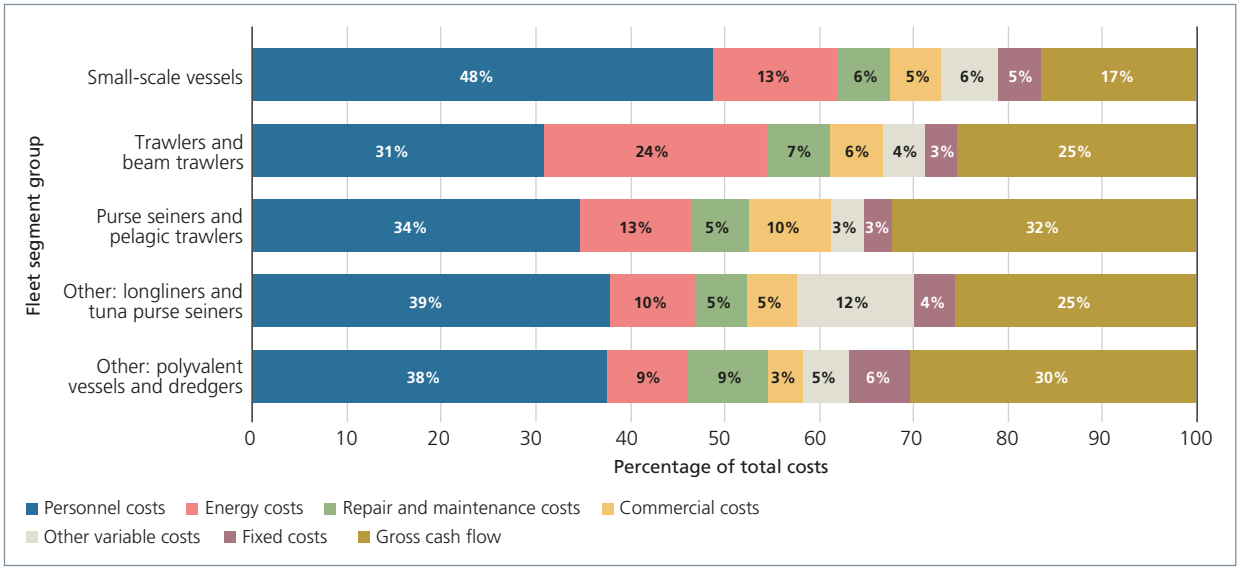
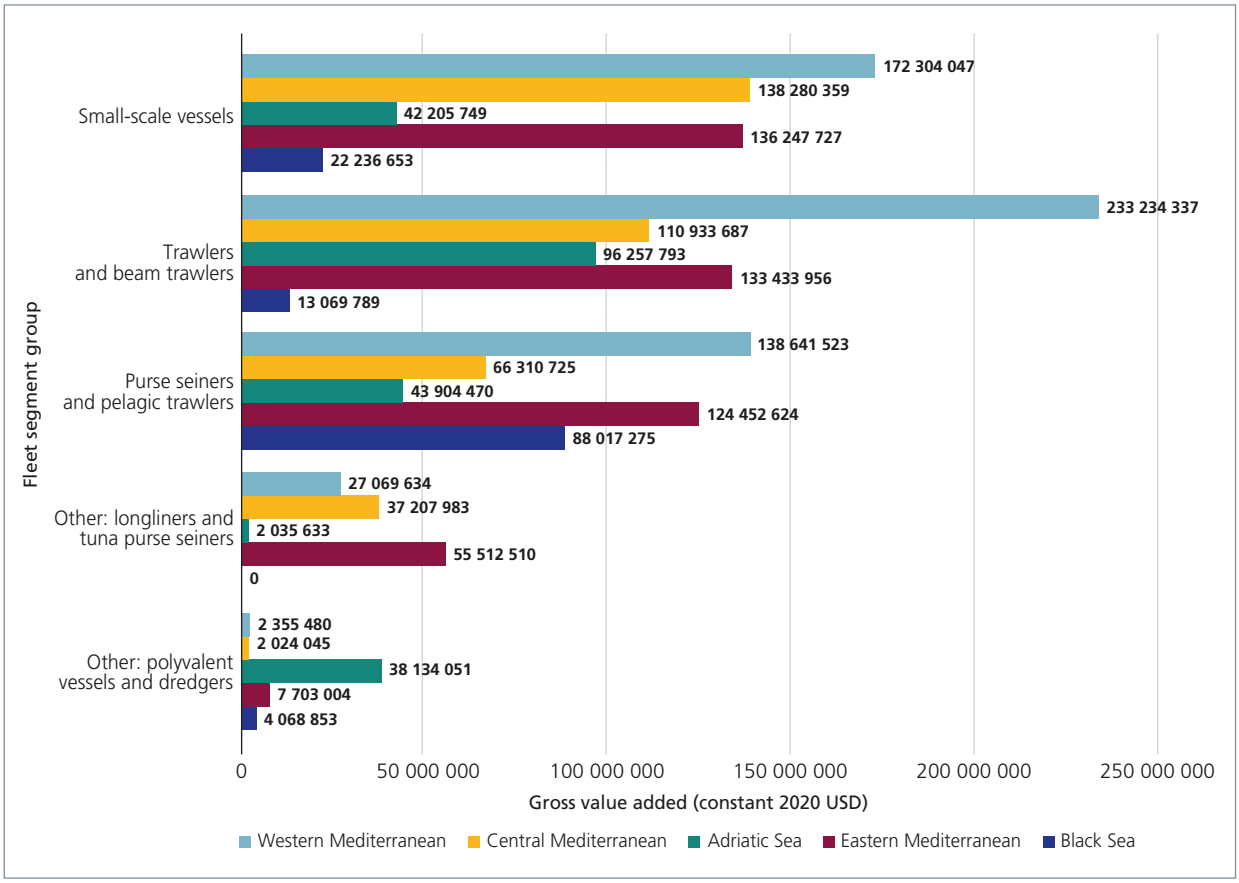


FIGURE 46. Gross value added by fleet segment group and GFCM subregion



The contribution of each fleet segment group to GVA varies, however, across the different GFCM subregions (Figure 46). Trawlers and beam trawlers represent the main contributor to GVA in the Adriatic Sea (43.3 percent of total GVA from fishing in the subregion) and the western Mediterranean (40.7 percent), whereas small-scale vessels represent the main contributor to GVA in the central Mediterranean (39 percent of total GVA from fishing in the subregion) and the eastern Mediterranean (29.8 percent). Purse seiners and pelagic trawlers represent the main contributor to GVA in only the Black Sea (69.1 percent of total GVA from fishing in the subregion).

In considering the wealth generated by fishing activities (i.e. GVA), it is important to also take into account the sector's reliance on operating subsidies (e.g. the amount of direct monetary subsidies) received by fishing vessel owners from the government to either support the fishing activity or facilitate investments. Operating subsidies can take different forms and may include capacity-enhancing subsidies, such as fuel subsidies, as well as direct support to fishers. This latter category featured as an important tool employed by governments in response to the COVID-19 pandemic. A preliminary analysis of data on subsidies provided by 12 CPCs[10] indicates that approximately USD 99.9 million in subsidies were provided in 2020, representing 5.8 percent of GVA for all fleet segment groups. Subsidies were not distributed evenly across fleet segment groups (Figure 47): trawlers and beam trawlers received the majority of subsidies (44 percent of total subsidies, representing 7.4 percent of GVA for this fleet segment group), followed by small-scale vessels (33 percent of total subsidies, representing 6.5 percent of GVA).

Physical capital (fleet value)

The value of the fleet, including the vessels' hulls, engines, onboard equipment and gear – better known as physical capital – can provide an

[10] Based on an analysis of data reported through the DCRF online platform from the following CPCs: Bulgaria, Cyprus, Greece, Italy, Lebanon, Malta, Montenegro, Romania, Slovenia, Spain, Tunisia and Türkiye.

FIGURE 47. Subsidies as a percentage of gross value added by fleet segment group

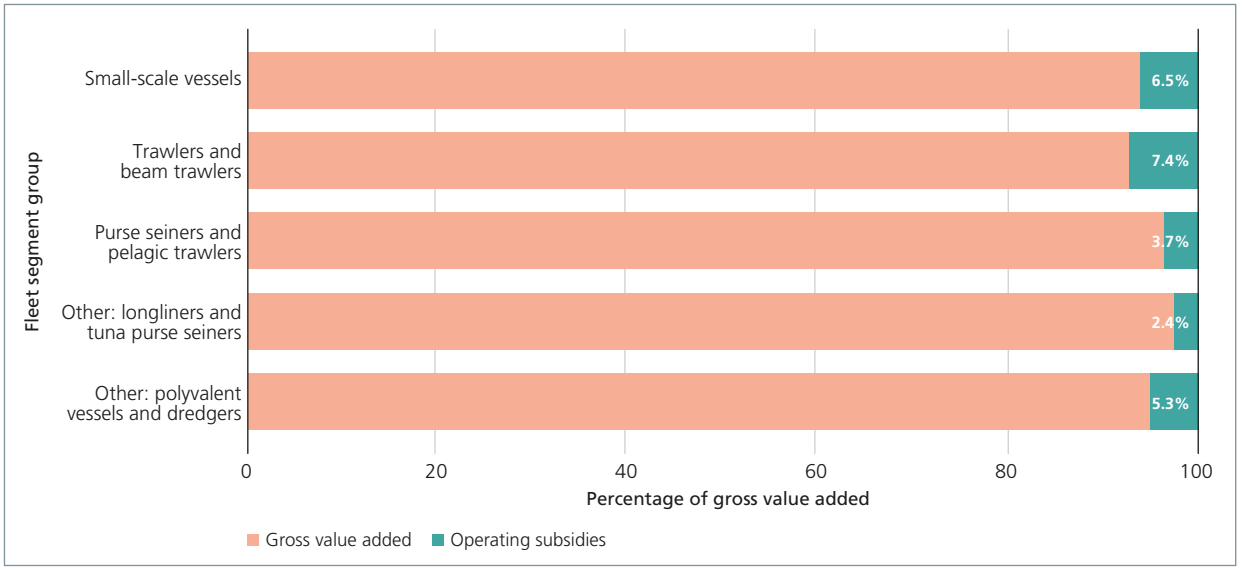
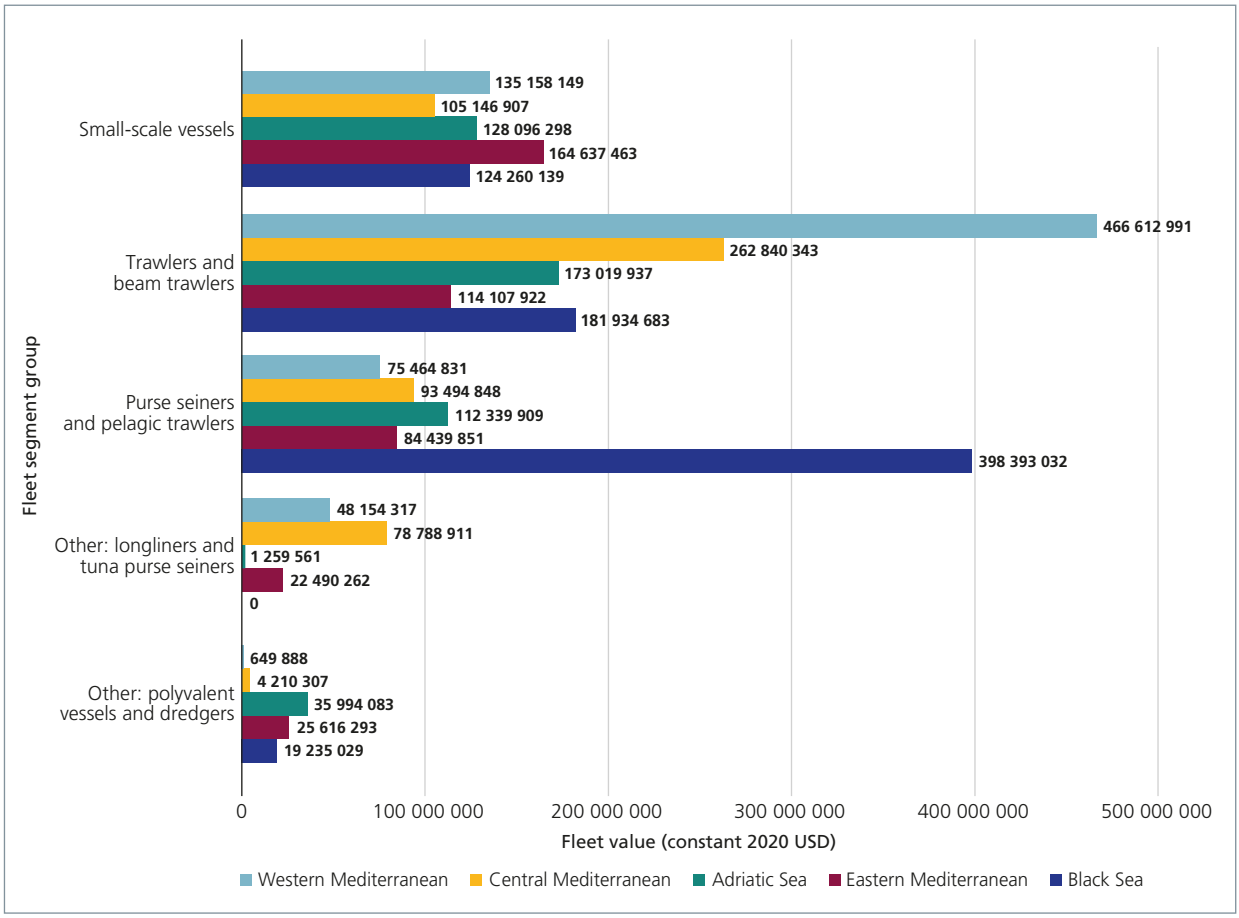


FIGURE 48. Fleet value by fleet segment group and GFCM subregion



indication of fishing capacity. Data submissions on the value of the fleet have become more complete in recent years, and the total physical capital (i.e. the value of the Mediterranean and Black Sea fishing fleet) is estimated at USD 2.8 billion in 2020. This large figure shows the significant investment tied up in the regional fleet, whose value almost equals the total annual

revenue from fisheries in the region. Trawlers and beam trawlers represent 42 percent of the total value, purse seiners and pelagic trawlers represent 26.8 percent and small-scale vessels represent 23 percent (Figure 48).

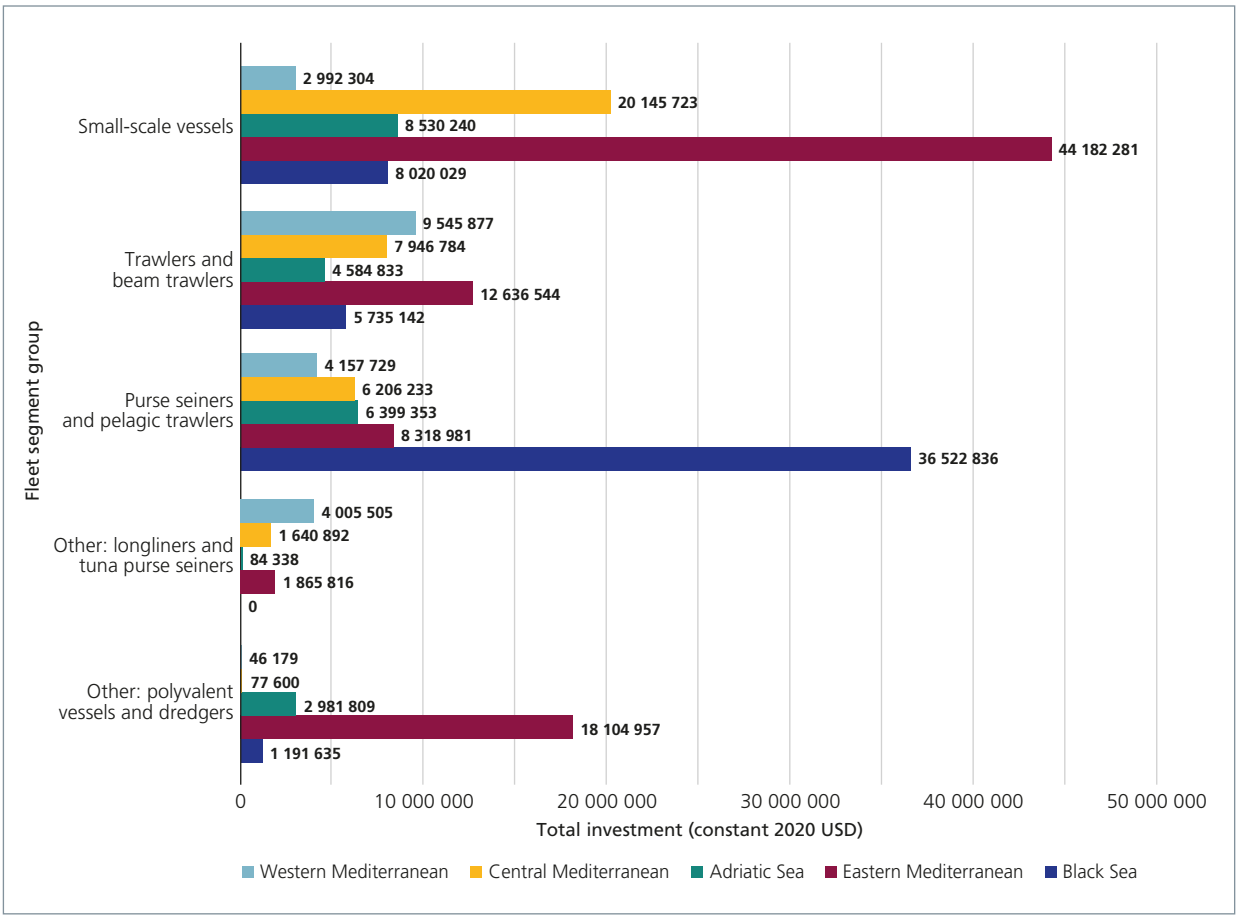
Across the region, however, the relative contributions of the different fleet segment groups to physical capital varies significantly (Figure 48). The value of trawlers and beam trawlers in the western Mediterranean remains particularly high (representing 64.3 percent of the entire value of the subregional fleet), as does the value of purse seiners and pelagic trawlers in the Black Sea (representing 55 percent of the entire value of the subregional fleet). In the eastern Mediterranean, the value of small-scale vessels is significant, representing 40 percent of the entire value of the subregional fleet.

Annual investments

Annual investments to improve existing vessels or gear during a given year play into the economic dynamics of the sector. Total investments in 2020, based on more complete data submissions by CPCs than in previous years, are estimated at approximately USD 215.9 million, with 38.8 percent of the value of all investments in the region directed towards small-scale vessels, 28.5 percent going to purse seiners and pelagic trawlers and 18.7 percent going to trawlers and beam trawlers.

Subregional variations are significant, however (Figure 49). The high value of investment in small-scale vessels (51.9 percent of all investments in the subregion) and polyvalent vessels and dredgers (21.3 percent of all investment in the subregion) in the eastern Mediterranean is noteworthy. Small-scale vessels also receive a majority (55.9 percent) of investment in the central Mediterranean. In the Black Sea, purse seiners and pelagic trawlers are not only the fleet segment group with the highest value (Figure 48), but they also receive the majority of investments in the subregion (71 percent).

FIGURE 49. Total annual investment in physical capital by fleet segment group and GFCM subregion



THE CONTRIBUTION OF FISHERIES TO LIVELIHOODS

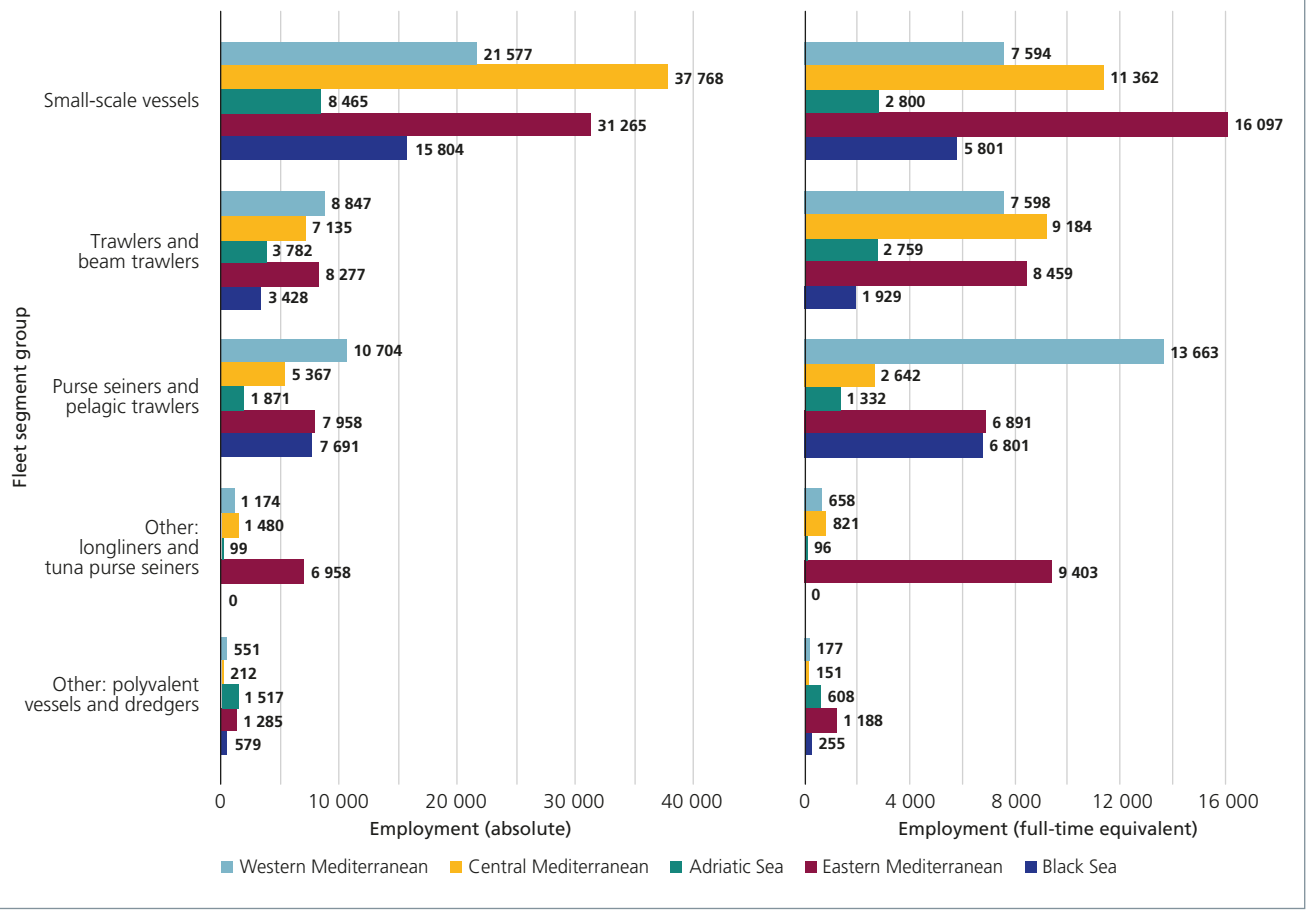
Employment

Capture fisheries provide an important source of livelihoods in the Mediterranean and Black Sea region. However, employment on board fishing vessels varies across subregions and fleet segments (Figure 37 and Figure 38). Figure 50 shows that, at the regional level, small-scale vessels generate the highest number of (absolute) on-vessel jobs (59.3 percent of total employment), followed by purse seiners and pelagic trawlers (17.3 percent) and then trawlers and beam trawlers (16.2 percent).

Further examination of employment at the subregional level (Figure 50) shows that small-scale vessels remain the most important employer across all subregions, accounting for 72.7 percent of employment in the central Mediterranean, 57.5 percent in the Black Sea, 56.1 percent in the eastern Mediterranean, 53.8 percent in the Adriatic Sea and 50.4 percent in the western Mediterranean. Purse seiners and pelagic trawlers are the second most important fleet segment group in terms of employment in the Black Sea and the western Mediterranean (accounting for 28 percent and 25 percent of employment, respectively), whereas trawlers and beam trawlers are the second most important fleet segment group in the Adriatic Sea (24 percent of employment), eastern Mediterranean (14.8 percent of employment) and central Mediterranean (13.7 percent of employment).

Absolute employment data take into account the number of workers employed on board vessels, including those working on a part-time basis. Pluriactivity (i.e. practising two or more different professional activities), however, is common in the fishing sector, and many fishers are also engaged part-time in other sectors, such as agriculture, manufacturing and tourism. Given this variation in workloads among fishers, comparison of employment information across subregions and

FIGURE 50. Employment by fleet segment group and GFCM subregion



fleet segment groups is facilitated by the full-time equivalent (FTE) indicator. Full-time equivalent employment equals the number of FTE 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.

In FTE terms, the contribution of each fleet segment group to total employment changes (Figure 50). Small-scale vessels still generate, on average, the highest number of jobs in the region, but to a lesser extent (36.9 percent of FTE employment). This shift aligns with the outcomes of socioeconomic studies carried out by the GFCM, which have shown that over 34 percent of small-scale vessel owners in the region are engaged in other professional activities in addition to fishing (FAO, 2020a). On the other hand, purse seiners and pelagic trawlers, and trawlers and beam trawlers account for, in FTE terms, 26.5 percent and 25.3 percent of total onboard vessel employment, respectively. It is important to recognize, however, that FTE analyses do not fully capture the nature of SSF work, as they only consider time at sea, whereas a significant part of SSF work is shore-based.

Across the region, the importance of each fleet segment group in FTE terms also varies significantly. For example, in both the western Mediterranean and the Black Sea, the fleet segment group accounting for the highest number of FTE jobs are purse seiners and pelagic trawlers (46 percent of FTE employment in both subregions). In all other subregions, small-scale vessels represent the highest number of FTE jobs, with the following proportions: 47 percent in the central Mediterranean, 38.3 percent in the eastern Mediterranean and 36.9 percent in the Adriatic Sea.

Furthermore, the nature of the work carried out on board, as well as the number of people working on board a vessel at a given time, differ by fleet segment group. Figure 51 illustrates these variations in the average number of employees per vessel by fleet segment group. Small-scale vessels employ, on average, 1.7 fishers per vessel, whereas the average purse seiner or pelagic trawler employs approximately ten fishers and the average trawler or beam trawler employs approximately five fishers.

Remuneration per fisher

While employment data provide an indication of the social impact of the fishing sector, other indicators provide greater insight into the sector's contribution to the livelihoods of fishers. In addition to GVA, discussed in the earlier section on "Profitability and wealth generation", another important indicator of livelihoods is remuneration. Remuneration includes both cash and in-kind payments (e.g. a share of the catch for self-consumption) and can either be fixed or

FIGURE 51. Average number of employees per vessel by fleet segment group

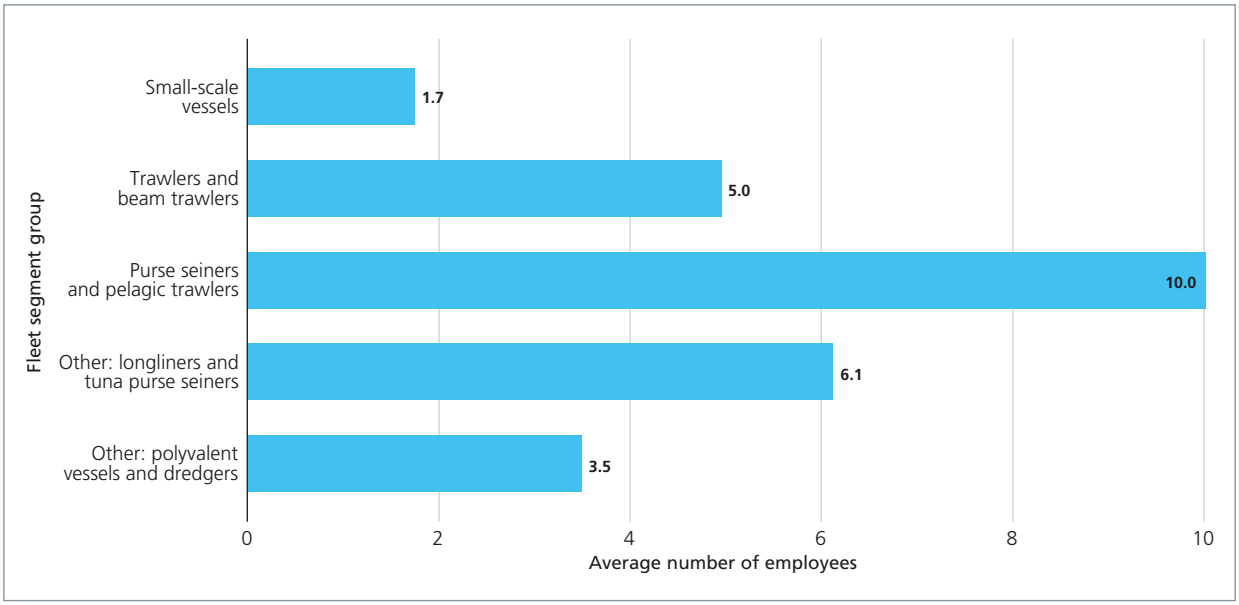
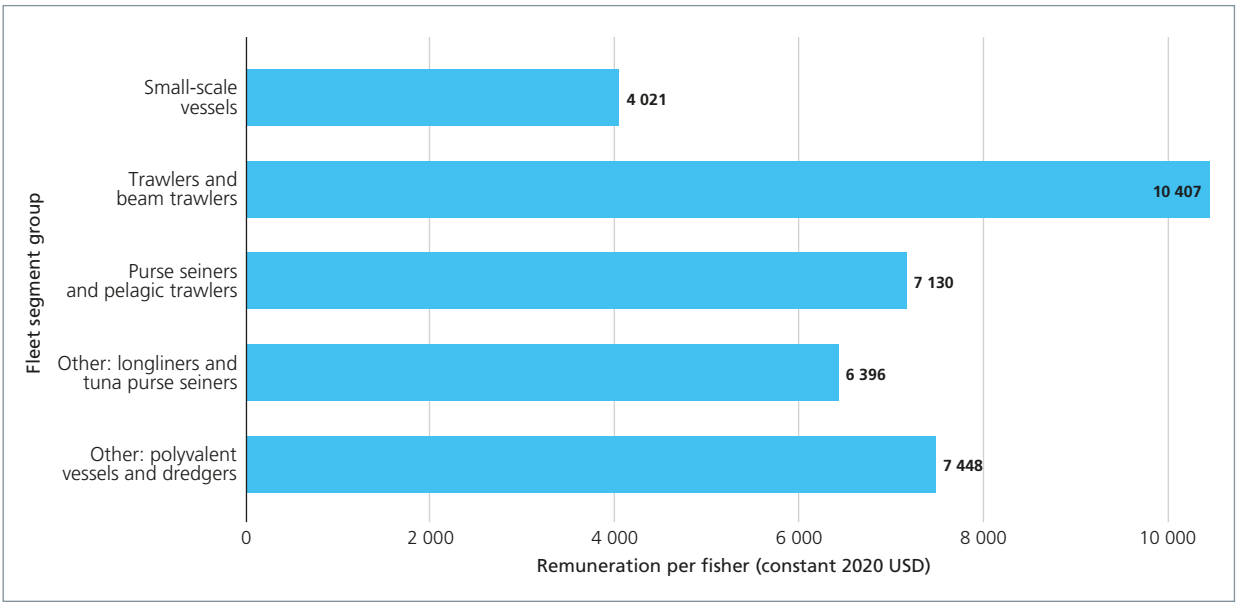


FIGURE 52. Annual remuneration per fisher (in absolute terms) by fleet segment group



in proportion to the fishing vessel's profit (revenue minus certain operating costs). Available data on the remuneration per fisher only considers cash payments (thereby excluding in-kind payments) and is calculated by dividing total personnel costs by the number of fishers.

Annual remuneration per fisher (absolute employment) is, on average, around USD 6 086 in the GFCM area of application. Remuneration of fishers in industrial fleet segment groups (USD 8 366 per fisher) is, on average, double the average annual remuneration per small-scale fisher (USD 4 021) (Figure 52).

Demographic characteristics

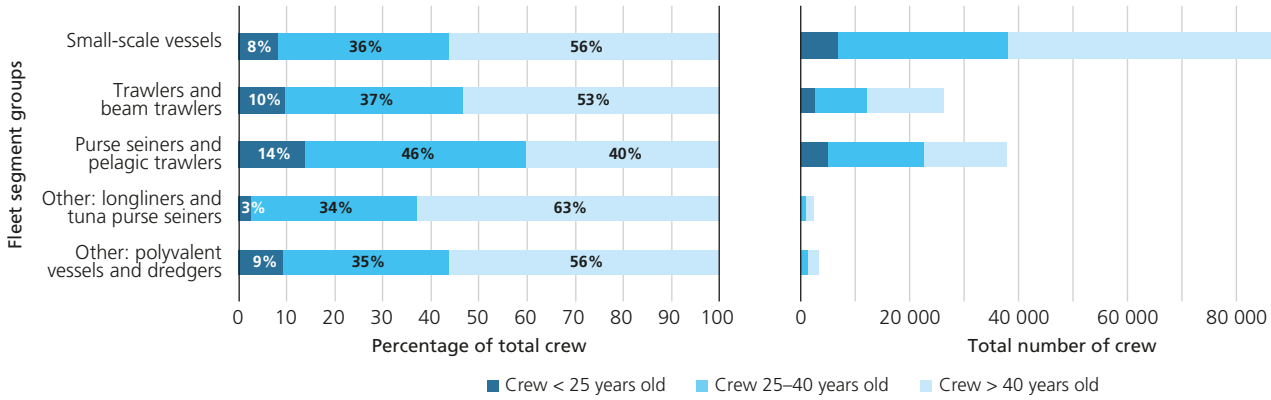
The age distribution of fishers employed on board fishing vessels provides important insights into the demographic characteristics of the region's fishing sector. Available data show that fishers are an ageing population, and fewer and fewer young people are entering the sector's workforce. On average, in comparison with the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a), 10 percent of the crew is younger than 25 years old (as compared with 17 percent), 38 percent is between 25 and 40 years old (as compared with 35 percent), and 52 percent is over 40 years old (as compared with 49 percent). This lack of generational turnover has important implications for the long-term sustainability of the fishing sector, including for the transfer of fishers' local ecological knowledge.

Additional insights come from further examination by fleet segment group (Figure 53). For example, although just 8 percent of small-scale fishers are under the age of 25 (only longliners and tuna purse seiners have proportionately fewer fishers under 25 years old), SSF still employ a higher total number of young people than any other fleet segment group. It is also notable that the majority of young fishers are found in the western Mediterranean (57.4 percent of all fishers under 25 years old), followed by the central Mediterranean (18.7 percent), the Black Sea (12.3 percent), the eastern Mediterranean (8.8 percent) and finally the Adriatic Sea (2.7 percent).

VALUE CHAIN

The full social and economic value of Mediterranean and Black Sea fisheries cannot be measured solely through vessel-based fishing employment and first sale revenue. Fisheries provide crucial livelihoods and generate income up and down the value chain, including in sectors such as boat building, net manufacturing and repair, fish processing and fish marketing, as well as in non-vessel-based fishing activities, such as shore-based fishing and gleaning. Often, a higher proportion of women work in these fisheries-related sectors. Recognizing that improvements in the understanding of the distribution of

FIGURE 53. Age distribution of crew by fleet segment group



benefits along the value chain are essential in order to discern the dynamics that may affect fisher behaviour and thus fisheries management, as well as to avoid the marginalization of certain groups (e.g. women) and to foster innovation, the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and Black Sea (GFCM 2030 Strategy) calls for improved data collection along the full fisheries value chain (FAO, 2021).

Trade

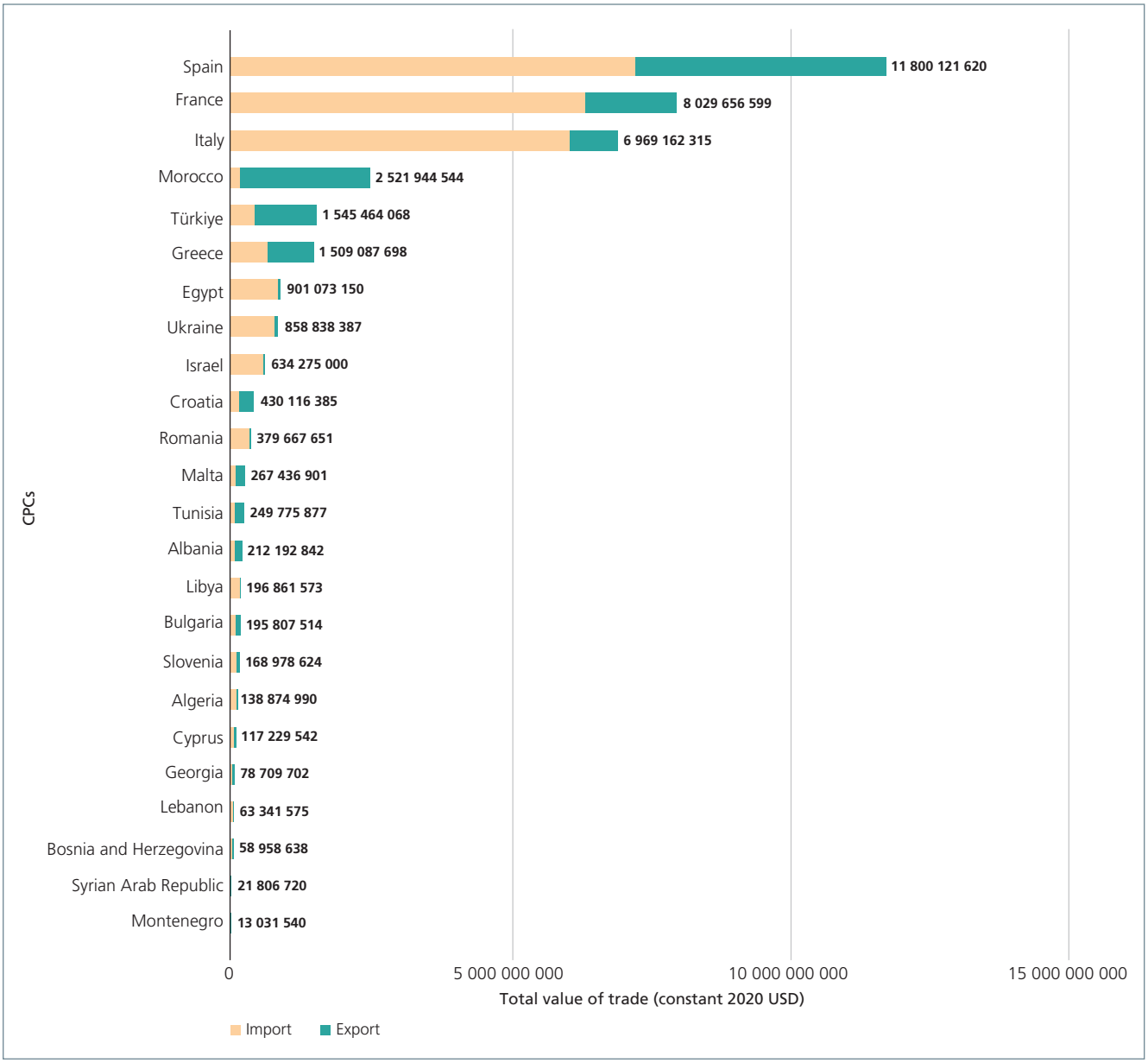
Fish trade is one aspect of the fisheries value chain that generates significant value. Fish and fishery products are some of the most highly traded food commodities in the world by value (FAO, 2022b). The Mediterranean and Black Sea region is no exception, with the trade of fish products – particularly between European Union and non-European Union CPCs – crucial to the profitability of the region's fisheries sector. Furthermore, trade is essential not only for industrial fisheries, but also for SSF: in certain countries, despite the predominance of short value chains and more direct sales of products at the local level, 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 application in 2020 was USD 37.4 billion (Figure 54). While this figure represents over 12.5 times the revenue at first sale for the same year, it nevertheless represents a decline of over 10 percent compared with the total value of traded fish products presented in the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a). This decrease parallels trends seen around the world in 2020, as reported in the *State of World Fisheries and Aquaculture* 2022 (FAO, 2022b). Indeed, during the early months of the COVID-19 pandemic, the closure of borders and restrictions on the import and export of goods had a significant impact on trade, presenting a plausible explanation for the decline (GFCM, 2020a, 2020b).

As trade data are not collected through the GFCM, data are obtained from the FAO Global fish trade database (reference year 2020) (FAO, 2022c) 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 and re-exports, as well as capture fishery products originating from outside the GFCM area of application for those countries that border multiple FAO fishing areas (i.e. Egypt, France, Morocco and Spain).

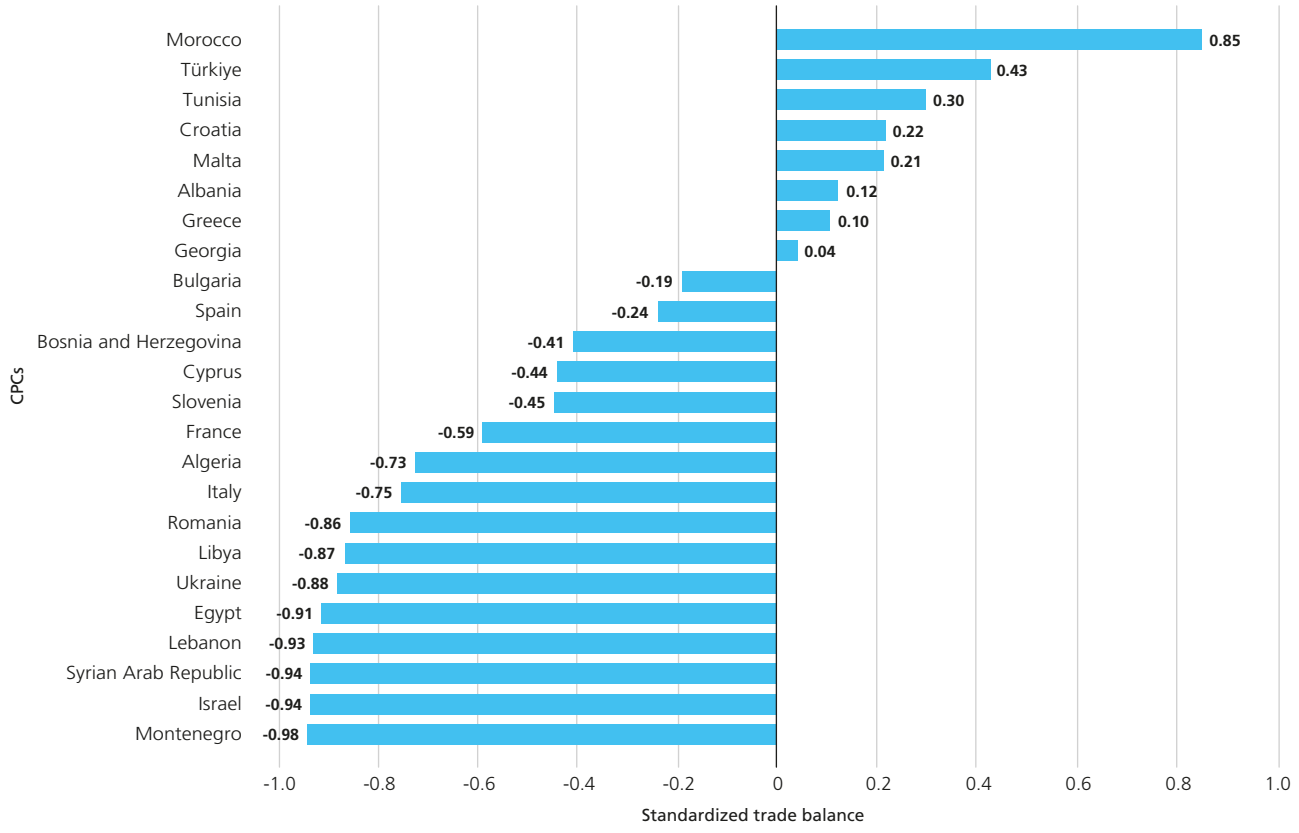
In addition to the total value of trade, it is useful to understand the standardized trade balance (STB), which indicates whether a country is a net importer or a net exporter of fishery products. It is calculated as a percent ratio between the simple balance (exports minus imports) and the total volume of trade (exports plus imports). An STB of -1 indicates 100 percent net imports and an STB of 1 indicates 100 percent net exports; an STB of 0 indicates a perfect balance between imports and exports.

FIGURE 54. Total value of traded fish products by GFCM contracting party and cooperating non-contracting party (imports and exports)



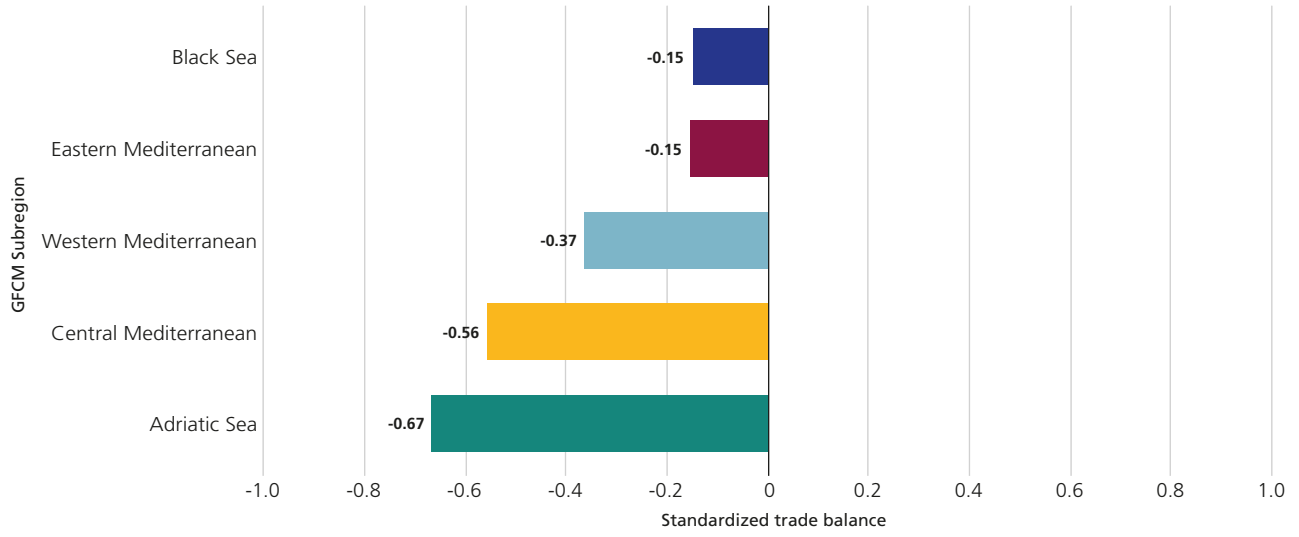
In the GFCM area of application, CPCs are generally net importers (Figure 55). In particular, Montenegro, Israel, the Syrian Arab Republic and Lebanon depend almost entirely on imports of fishery products, although they are slightly less dependent on imports than in the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a). On the other hand, Morocco, and to a lesser extent Türkiye and Tunisia, have significant net export ratios. At the subregional level, all GFCM subregions are net importers of fish products (Figure 56), with the Adriatic Sea subregion most highly dependent on imports, although all subregions are slightly less dependent on imports than in 2020 (FAO, 2020a). 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 57), with lower-income countries tending to export more and higher-income countries importing more.

FIGURE 55. Standardized trade balance by GFCM contracting party and cooperating non-contracting party



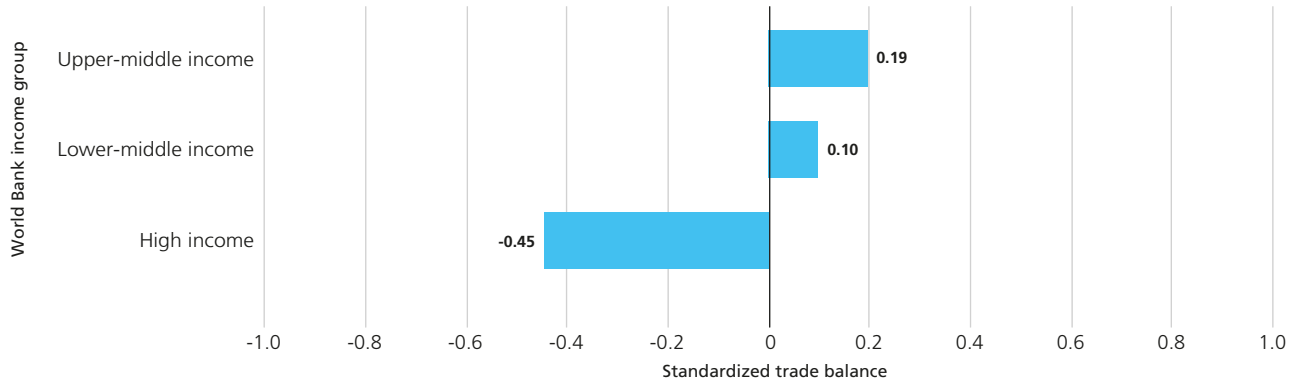
Note: -1 = 100% imports; 1 = 100% exports.

FIGURE 56. Standardized trade balance by GFCM subregion



Note: -1 = 100% imports; 1 = 100% exports.

FIGURE 57. Standardized trade balance by income group classification



Note: -1 = 100% imports; 1 = 100% exports.

Box 11. Integrating socioeconomic data in fisheries management: a closer look at key fisheries

Socioeconomic data provide an essential snapshot of the economic and social status of the region's fishing fleet, as well as of the fishers that depend on it, indicating trends over time. However, as socioeconomic data collection by GFCM contracting parties and cooperating non-contracting parties improves, socioeconomic data can be used in ways that more directly support fisheries management. For example, beyond informing an *ex post* assessment of the impacts of existing management plans, socioeconomic data can also facilitate modeling the implications of future management scenarios, providing decision-makers with indications of which scenarios might be most successful in reaching management objectives, while also taking into account the economic impacts on fishers.

The GFCM is putting in place the building blocks to support continued integration of socioeconomic data into fisheries management decision-making processes. Socioeconomic data collection has been included as a pillar of dedicated species-specific research programmes in view of strengthening the overall management advice produced (see Chapter 7). For example, ad hoc species-specific socioeconomic surveys are underway as part of research programmes on red coral (*Corallium rubrum*), common dolphinfish (*Coryphaena hippurus*) and rapa whelk (*Rapana venosa*), among others. On the other hand, where data are already available and mature enough, ad hoc GFCM workshops on the assessment of management measures have advanced the evaluation of socioeconomic impacts. A closer look at the socioeconomic information for two fisheries subject to GFCM multiannual management plans – small pelagic fisheries in the Adriatic Sea and demersal fisheries in the Strait of Sicily – is provided hereafter.

Small pelagic fisheries in the Adriatic Sea – geographical subareas 17 and 18

The annual revenue of the Adriatic small pelagic fisheries was equal, in 2020, to around USD 125 million, registering a decrease of around 38 percent in comparison to 2019 (primarily due to the impacts of COVID-19). Adriatic small pelagic fisheries involve labour-intensive activities, with roughly six to seven crew members working on board each vessel in 2020. Consequently, personnel costs represent the biggest cost item (around 53 percent of the total production costs in 2020). When considering operative costs (those linked to the level of production), energy costs account for the biggest share (36 percent), followed by other variable costs, mainly commercial costs (28 percent). Repair and maintenance costs represent 20 percent of the whole cost burden.[1]

The annual employment created by these fisheries was equal, in 2020, to 2 248 full-time equivalent (FTE) jobs, registering a decrease of 29 percent in comparison to 2019. The decrease in FTE employment is substantially due to the

[1] **STECF (Scientific, Technical and Economic Committee for Fisheries).** 2022a. *The 2022 Annual Economic Report on the EU Fishing Fleet (STECF 22-06).* Luxembourg, Publications Office of the European Union.

(Continued)

reduction in days at sea per vessel (-11 percent) resulting from the lower thresholds set by the effort regime, as well as from the halts in fishing activity imposed by COVID-19 restrictions.

Furthermore, substantial landings from this fishery are destined for the post-harvest processing sector, meaning that the fishery also generates livelihoods farther along the value chain, particularly in Italy and Croatia, which are major producers of salted, prepared and preserved anchovies.[2] Croatian fish processors' demand for raw materials seems to be higher than the supply from local fisheries, which has resulted in the development of new strategies, e.g. diversification of production and increasing inflow of raw materials from other regions.[3]

Demersal fisheries in the Strait of Sicily – geographical subareas 12 to 16

Deep-water rose shrimp (*Parapenaeus longirostris*) and European hake (*Merluccius merluccius*) in the Strait of Sicily are targeted by bottom trawlers primarily from, but not limited to, Tunisia and Italy. Recognizing the importance of this fishery for the Tunisian fishing sector and noting that there were gaps in available knowledge of its socioeconomic impacts, a socioeconomic study of the demersal trawl fleet in northern Tunisia (geographical subarea 12) was carried out over the course of three years (2015–2017).[4] The fishery is considered profitable, with positive profits over the course of the reference period, reaching an average annual revenue of TND 217 579 000 (approximately USD 100 000 000, according to the average exchange rate from 2015–2017). The fishery relies heavily on international export markets, for which prices have remained high over the reference period.

The vessels targeting these species in this area belong to the fleet segments "trawlers 12–24 m" (T-11) and "trawlers > 24 m" (T-12) (see Box 6). With regard to operating costs for the two segments combined, personnel costs were the most significant, comprising 64.1 percent of total costs, followed by energy costs (19.6 percent), maintenance and repair costs (9.1 percent), other variable costs (3.9 percent), commercial costs (2.4 percent) and fixed costs (0.9 percent). The relatively low impact of fuel costs on revenue, as compared with the regional average, underlines the important role of fuel subsidies in this fishery.

Approximately 2 182 fishers actively work in this fishery. These fishers are relatively young, with the majority between 35–45 years old with more than 15 years of experience and an average household size of 2.8 people, highlighting the potential for continuity and social sustainability in this fishery. The average working time per day for this fishery was slightly above the International Labour Organization maximum threshold defined as 14 hours (14.6 hours for the T-11 fleet segment and 14.9 hours for the T-12 fleet segment). The average annual remuneration per FTE over the three years was TND 31 744 (approximately USD 14 500) for the fleet segment T-11 and TND 48 444 (approximately USD 22 300) for the fleet segment T-12. The survey reveals a well-performing fishery, in terms of employment and demographic indicators, but encourages the consideration of social protection and other employment-related policies to further support its social sustainability.

[2] **EUFOMA (European Market Observatory for Fisheries and Aquaculture Products).** 2019. *Species analyses: 2014–2018 edition*. Luxembourg, Publications Office of the European Union.

[3] **STECF.** 2022b. *Economic report on the fish processing industry (STECF-21-14)*. Luxembourg, Publications Office of the European Union.

[4] **Ben Arfa, Y., Di Cintio, A., Ceriola, L. & Jarboui, O.** 2022. Socioeconomic analysis of the trawl fleet targeting deep-water rose shrimp (*Parapenaeus longirostris*) and European hake (*Merluccius merluccius*) in North Tunisia (2015–2017). *Marine Policy*, 137: 10.

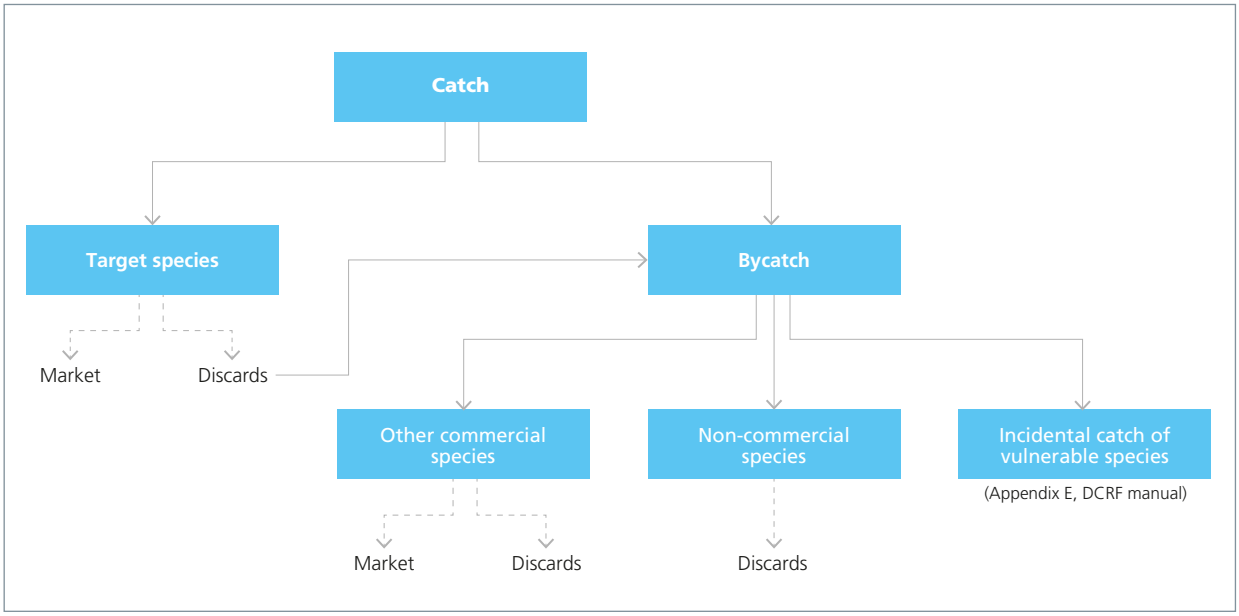
4. Bycatch: Discards and incidental catch of vulnerable species

Bycatch, which includes discards and the incidental catch of vulnerable species (Figure 58), is a complex concept with significant implications for the sector, including from economic, regulatory and public points of view. It can affect the survival of commercial and non-commercial resources (i.e. discards) and can threaten vulnerable species (i.e. incidental catch). From a human perspective, bycatch negatively influences public perception of the sector, drives the need for regulations and limitations on the use of resources, and affects the future yields of harvested resources, increasing the mortality of juvenile and undersized individuals of target species by removing them before they reach their optimal size. Furthermore, in economic terms, bycatch incurs additional costs without increasing revenues and may hinder profitability.

Bycatch of vulnerable species jeopardizes the conservation of a variety of species groups, including marine mammals, seabirds, sea turtles and elasmobranchs.

Understanding bycatch and adopting effective measures to reduce it therefore represent essential steps towards minimizing the discards produced by fisheries and their impacts on vulnerable

FIGURE 58. Catch composition



species and marine ecosystems more generally, 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. The application of common protocols and methodologies, as recently developed by the GFCM (Carpentieri, 2019a, 2019b), can provide a framework for the development and implementation of an efficient, standardized data collection and monitoring system for discards and the incidental catch of vulnerable species in all Mediterranean and Black Sea countries, while allowing for replication and comparisons among fisheries across the region and offering a harmonized basis of knowledge, information and evidence for decision-making.

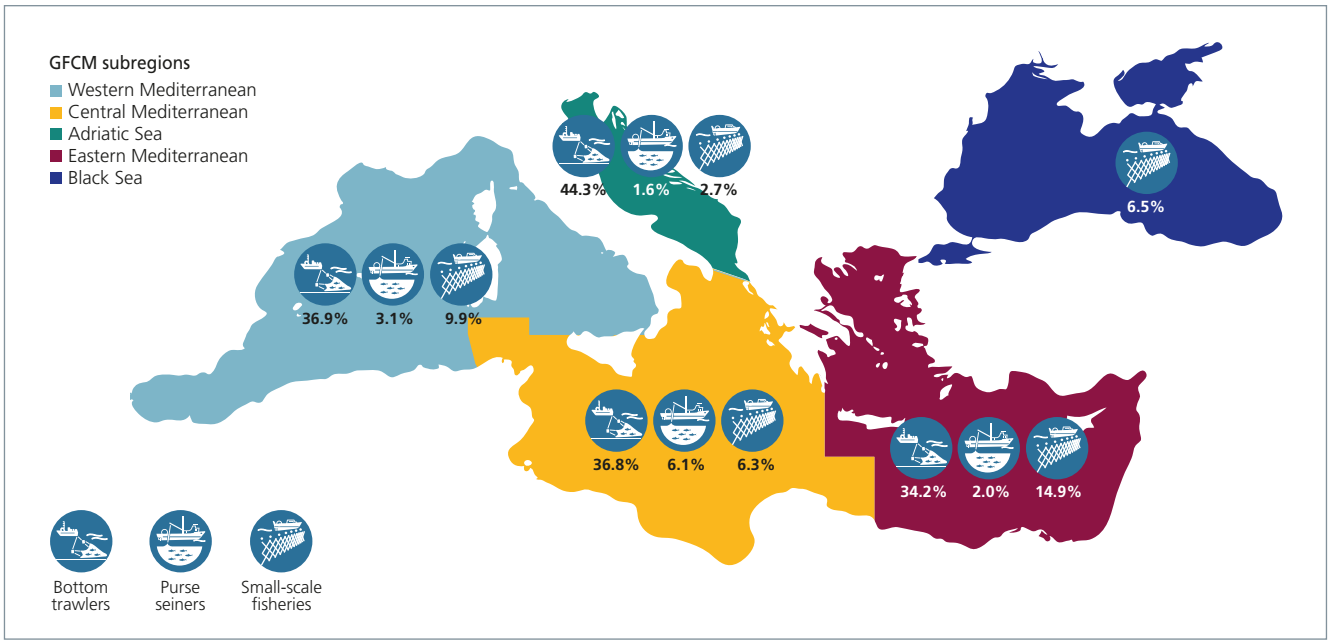
DISCARDS

Introduction

Discards are considered among the most important global issues for fisheries management. Returning part of the catch back into the sea, for whatever reason, is a topic of discussion among fisheries scientists and managers and even the wider public (Borges, 2015; Sardà *et al.*, 2015; Veiga *et al.*, 2016). Discards can affect biodiversity by impacting top predators, removing individuals from populations or eliminating prey; it can disturb the ecosystem by transferring biomass between water layers or lead to overexploitation when the level of capture is not sustainable for a species. The variety of factors (e.g. economic, legal, cultural, natural, biological, technical) affecting discards render the issue quite complex for fisheries scientists and managers (Bellido *et al.*, 2011; Santiago *et al.*, 2015; Uhlmann *et al.*, 2014). The Mediterranean and Black Sea's diversity of marine environments, multigear specificity, multispecies fisheries and wide range of cultural characteristics can influence and distinguish discard patterns in the basins.

This chapter provides an overview, based on the latest information collected and reported by countries through the online platform of the GFCM Data Collection Framework (DCRF) (GFCM, 2018), of the discarding behaviours of major vessel groups in the Mediterranean and Black Sea subregions.

FIGURE 59. Discard ratios of bottom trawlers, purse seiners and small-scale fisheries by GFCM subregion



Sources of information

The most up-to-date information on discards comes from DCRF Subtask II.2, which requests countries to submit their total catch (landings and discards) by geographical subarea (GSA) and fleet segment for the main commercial species as identified at the national level (GFCM, 2018). This information, covering data submissions from 2016 to 2021, is presented as a discard ratio, which is defined as the discarded fraction (in weight) of the total catch (discards + landings) of a vessel group by either species or species group or of all species aggregated, depending on the context, and is expressed as a percentage (i.e. discard fraction / total catch × 100). The analysis of DCRF data collected and reported in Subtask II.2 at the national level has allowed for discard estimates to be calculated for each GFCM subregion and main commercial species (as included in Appendix A of the DRCF; GFCM, 2018) and by major vessel group (i.e. small-scale fisheries, bottom trawlers, beam trawlers, longliners, purse seiners, pelagic trawlers and dredgers) as identified in Appendix B of the DCRF (GFCM, 2018).

Discard ratios by vessel group and GFCM subregion

Bottom trawlers

In the Mediterranean and the Black Sea, bottom trawlers are the most important vessel group in terms of the economic value of the catch and the second largest after small pelagic fisheries (i.e. purse seiners and pelagic trawlers) in terms of landings (see Chapters 2 and 3). Several bottom trawl fisheries are active across the GFCM subregions, and both landing composition and discards vary according to the species targeted and the depth stratum at which the fisheries operate. Mediterranean trawl fisheries generally exhibit a discard ratio around 40 percent and are one of the most significant contributors to the so-called "discards problem".

Based on the available data, the highest discard ratio value was obtained for the Adriatic Sea (44.3 percent), while discard ratios ranged between 34 and 37 percent in the other GFCM subregions (Figure 59).

At the regional level, discard ratios for target species such as European hake (*Merluccius merluccius*), Norway lobster (*Nephrops norvegicus*) and deep-water rose shrimp (*Parapenaeus longirostris*) were very low (generally well below 11 percent of the total species catch). The two coastal species red mullet (*Mullus barbatus*) and surmullet (*Mullus surmuletus*) showed higher fluctuations,

TABLE 12. Discard ratios for main commercial species targeted by bottom trawlers by GFCM subregion

Species	Western Mediterranean	Central Mediterranean	Adriatic Sea	Eastern Mediterranean	Black Sea
Giant red shrimp *(Aristaeomorpha foliacea)*	0.03%	0.20%	–	–	–
Blue and red shrimp *(Aristeus antennatus)*	0.48%	0.10%	–	–	–
Aristeidae	–	–	–	0.80%	–
Bogue *(Boops boops)*	83.27%	36.45%	86.77%	47.35%	–
European hake *(Merluccius merluccius)*	9.80%	7.80%	6.09%	9.20%	–
Red mullet *(Mullus barbatus)*	4.26%	1.02%	14.20%	0.46%	–
Surmullet *(Mullus surmuletus)*	6.81%	0.83%	13.67%	0.21%	–
Norway lobster *(Nephrops norvegicus)*	1.48%	2.88%	2.23%	3.21%	–
Common pandora *(Pagellus erythrinus)*	28.55%	63.23%	55.15%	11.55%	–
Deep-water rose shrimp *(Parapenaeus longirostris)*	4.79%	9.50%	8.61%	7.38%	–
Mediterranean horse mackerel *(Trachurus mediterraneus)*	54.65%	93.90%	67.23%	–	–
Atlantic horse mackerel *(Trachurus trachurus)*	76.92%	68.34%	56.32%	–	–
Jack and horse mackerels nei *(Trachurus* spp.*)*	–	–	–	9.11%	–

as, though they appear to be completely retained in the central and eastern Mediterranean, they are subject to discarding (between 4–14 percent) in the western Mediterranean and in the Adriatic Sea. Another coastal species, red pandora (*Pagellus erythrinus*), also showed highly fluctuating discard ratios depending on the area of catch. However, the red shrimp species *Aristaeus antennatus* and *Aristaeomorpha foliacea* experience negligible discards throughout the basin. In contrast, discard ratios for bogue (*Boops boops*), mackerel (*Trachurus* spp.) and small pelagic species (European anchovy [*Engraulis encrasicolus*] and sardine [*Sardina pilchardus*]), which can be considered as ancillary species of trawl fishing activity, exceeded 40 percent in the majority of records. As for the three most common elasmobranchs present in the trawl catch, blackmouth catshark *(Galeus melastomus)*, lesser spotted dogfish *(Scyliorhinus canicula)* and velvet belly lanternshark *(Etmopterus spinax)* are mostly discarded (> 70 percent). Discard ratio values are reported for the main commercial species by GFCM subregion in Table 12. No data were available to make a complete estimate for the Black Sea.

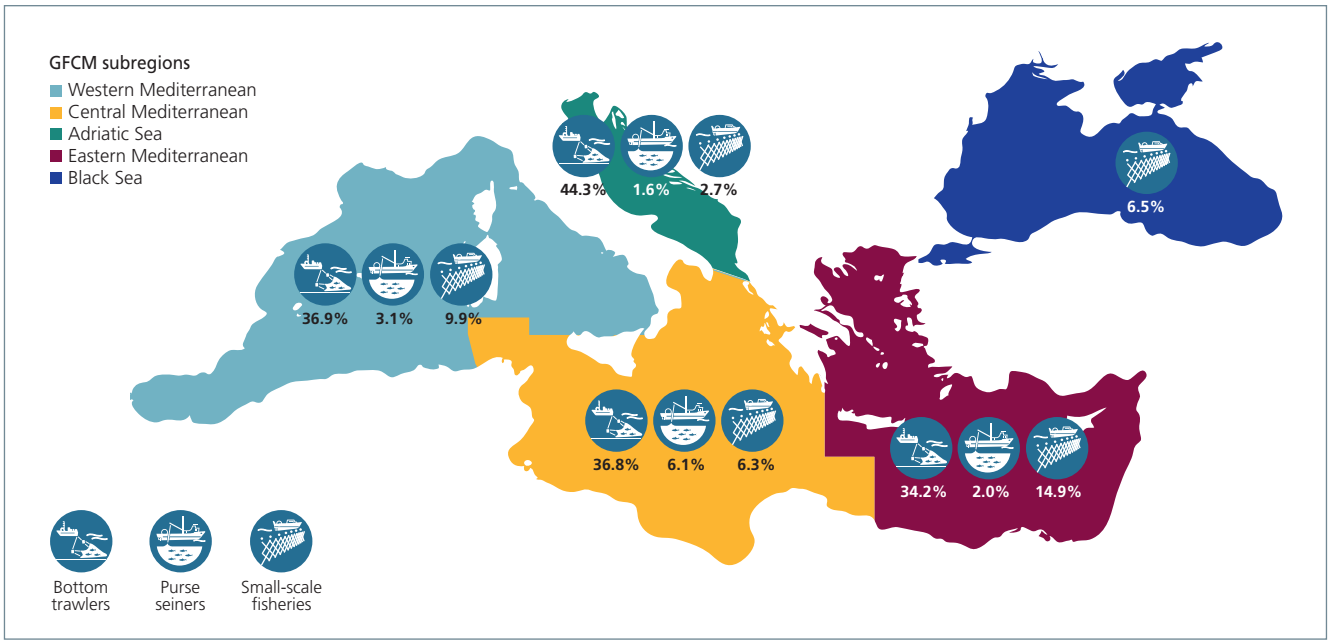
Purse seiners

Purse seiners targeting small pelagic fish – e.g. European anchovy, sardine and round sardinella (*Sardinella aurita*) – are active all along the coasts of the Mediterranean and the Black Sea and tend to be characterized by low discard ratios (generally below 6 percent; Figure 59), as their target species, anchovies and sardines, usually represent more than 90 percent of the catch (see Chapter 2). Discards are generally composed of non-target species – e.g. mackerels (*Scomber* spp. and *Trachurus* spp.), bogue – and of individuals of marketable species that are undersized or have low commercial value in certain periods. In any case, due to the large quantity of pelagic fish caught by purse seiners, even a relatively small discard ratio from this fishing activity may produce great volumes of discards. As with bottom trawlers, insufficient data were available from purse seiners to make a complete estimate for the Black Sea.

Small-scale fisheries

In the Mediterranean and the Black Sea, small-scale fisheries are characterized by the use of small boats and highly heterogeneous landings, types of fishing gear (e.g. trammel nets, gillnets, combined nets, longliners), fishing strategies and target species. The available information suggests that across the whole region, small-scale fisheries produce a low discard ratio (between 2.7 and 14.9 percent of total catch) (Figure 59).

FIGURE 59. Discard ratios of bottom trawlers, purse seiners and small-scale fisheries by GFCM subregion



Sources of information

The most up-to-date information on discards comes from DCRF Subtask II.2, which requests countries to submit their total catch (landings and discards) by geographical subarea (GSA) and fleet segment for the main commercial species as identified at the national level (GFCM, 2018). This information, covering data submissions from 2016 to 2021, is presented as a discard ratio, which is defined as the discarded fraction (in weight) of the total catch (discards + landings) of a vessel group by either species or species group or of all species aggregated, depending on the context, and is expressed as a percentage (i.e. discard fraction / total catch × 100). The analysis of DCRF data collected and reported in Subtask II.2 at the national level has allowed for discard estimates to be calculated for each GFCM subregion and main commercial species (as included in Appendix A of the DRCF; GFCM, 2018) and by major vessel group (i.e. small-scale fisheries, bottom trawlers, beam trawlers, longliners, purse seiners, pelagic trawlers and dredgers) as identified in Appendix B of the DCRF (GFCM, 2018).

Discard ratios by vessel group and GFCM subregion

Bottom trawlers

In the Mediterranean and the Black Sea, bottom trawlers are the most important vessel group in terms of the economic value of the catch and the second largest after small pelagic fisheries (i.e. purse seiners and pelagic trawlers) in terms of landings (see Chapters 2 and 3). Several bottom trawl fisheries are active across the GFCM subregions, and both landing composition and discards vary according to the species targeted and the depth stratum at which the fisheries operate. Mediterranean trawl fisheries generally exhibit a discard ratio around 40 percent and are one of the most significant contributors to the so-called "discards problem".

Based on the available data, the highest discard ratio value was obtained for the Adriatic Sea (44.3 percent), while discard ratios ranged between 34 and 37 percent in the other GFCM subregions (Figure 59).

At the regional level, discard ratios for target species such as European hake (*Merluccius merluccius*), Norway lobster (*Nephrops norvegicus*) and deep-water rose shrimp (*Parapenaeus longirostris*) were very low (generally well below 11 percent of the total species catch). The two coastal species red mullet (*Mullus barbatus*) and surmullet (*Mullus surmuletus*)

TABLE 12. Discard ratios for main commercial species targeted by bottom trawlers by GFCM subregion

Species	Western Mediterranean	Central Mediterranean	Adriatic Sea	Eastern Mediterranean	Black Sea
Giant red shrimp *(Aristaeomorpha foliacea)*	0.03%	0.20%	–	–	–
Blue and red shrimp *(Aristeus antennatus)*	0.48%	0.10%	–	–	–
Aristeidae	–	–	–	0.80%	–
Bogue *(Boops boops)*	83.27%	36.45%	86.77%	47.35%	–
European hake *(Merluccius merluccius)*	9.80%	7.80%	6.09%	9.20%	–
Red mullet *(Mullus barbatus)*	4.26%	1.02%	14.20%	0.46%	–
Surmullet *(Mullus surmuletus)*	6.81%	0.83%	13.67%	0.21%	–
Norway lobster *(Nephrops norvegicus)*	1.48%	2.88%	2.23%	3.21%	–
Common pandora *(Pagellus erythrinus)*	28.55%	63.23%	55.15%	11.55%	–
Deep-water rose shrimp *(Parapenaeus longirostris)*	4.79%	9.50%	8.61%	7.38%	–
Mediterranean horse mackerel *(Trachurus mediterraneus)*	54.65%	93.90%	67.23%	–	–
Atlantic horse mackerel *(Trachurus trachurus)*	76.92%	68.34%	56.32%	–	–
Jack and horse mackerels nei *(Trachurus* spp.*)*	–	–	–	9.11%	–

showed higher fluctuations, as, though they appear to be completely retained in the central and eastern Mediterranean, they are subject to discarding (between 4–14 percent) in the western Mediterranean and in the Adriatic Sea. Another coastal species, red pandora (*Pagellus erythrinus*), also showed highly fluctuating discard ratios depending on the area of catch. However, the red shrimp species *Aristaeus antennatus* and *Aristaeomorpha foliacea* experience negligible discards throughout the basin. In contrast, discard ratios for bogue (*Boops boops*), mackerel (*Trachurus* spp.) and small pelagic species (European anchovy [*Engraulis encrasicolus*] and sardine [*Sardina pilchardus*]), which can be considered as ancillary species of trawl fishing activity, exceeded 40 percent in the majority of records. As for the three most common elasmobranchs present in the trawl catch, blackmouth catshark *(Galeus melastomus)*, lesser spotted dogfish *(Scyliorhinus canicula)* and velvet belly lanternshark *(Etmopterus spinax)* are mostly discarded (> 70 percent). Discard ratio values are reported for the main commercial species by GFCM subregion in Table 12. No data were available to make a complete estimate for the Black Sea.

Purse seiners

Purse seiners targeting small pelagic fish – e.g. European anchovy, sardine and round sardinella (*Sardinella aurita*) – are active all along the coasts of the Mediterranean and the Black Sea and tend to be characterized by low discard ratios (generally below 6 percent; Figure 59), as their target species, anchovies and sardines, usually represent more than 90 percent of the catch (see Chapter 2). Discards are generally composed of non-target species – e.g. mackerels (*Scomber* spp. and *Trachurus* spp.), bogue – and of individuals of marketable species that are undersized or have low commercial value in certain periods. In any case, due to the large quantity of pelagic fish caught by purse seiners, even a relatively small discard ratio from this fishing activity may produce great volumes of discards. As with bottom trawlers, insufficient data were available from purse seiners to make a complete estimate for the Black Sea.

Small-scale fisheries

In the Mediterranean and the Black Sea, small-scale fisheries are characterized by the use of small boats and highly heterogeneous landings, types of fishing gear (e.g. trammel nets, gillnets, combined nets, longliners), fishing strategies and target species. The available information suggests that across the whole region, small-scale fisheries produce a low discard ratio (between 2.7 and 14.9 percent of total catch) (Figure 59).

FIGURE 60. Relative contributions of main vessel groups to the total incidental catch of vulnerable species groups in the GFCM area of application, 2000–2022

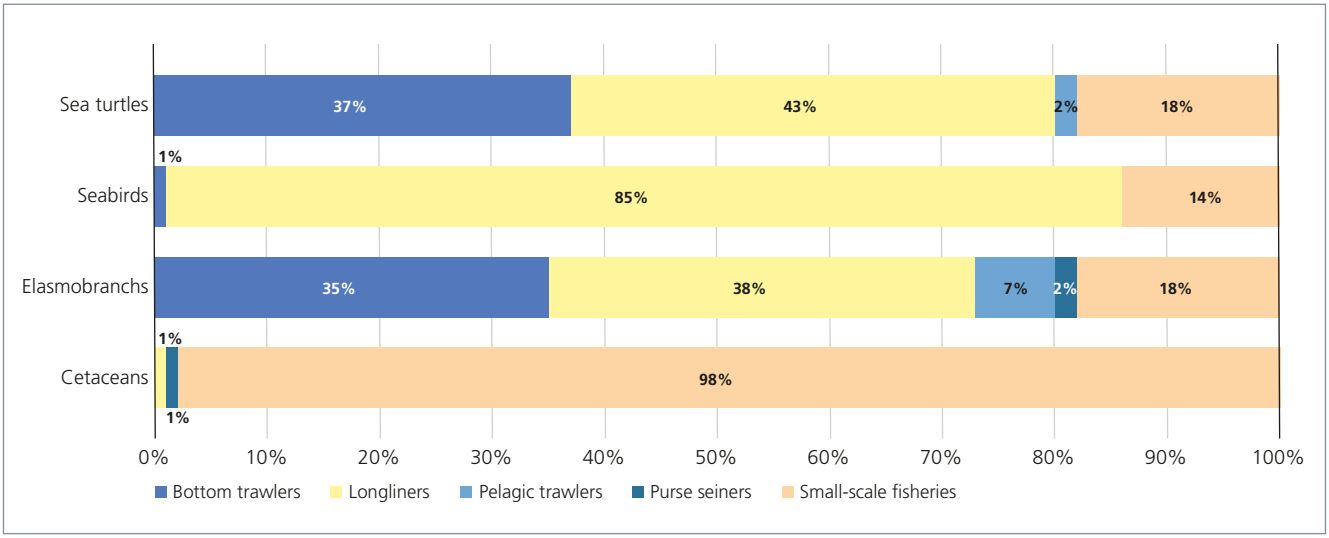
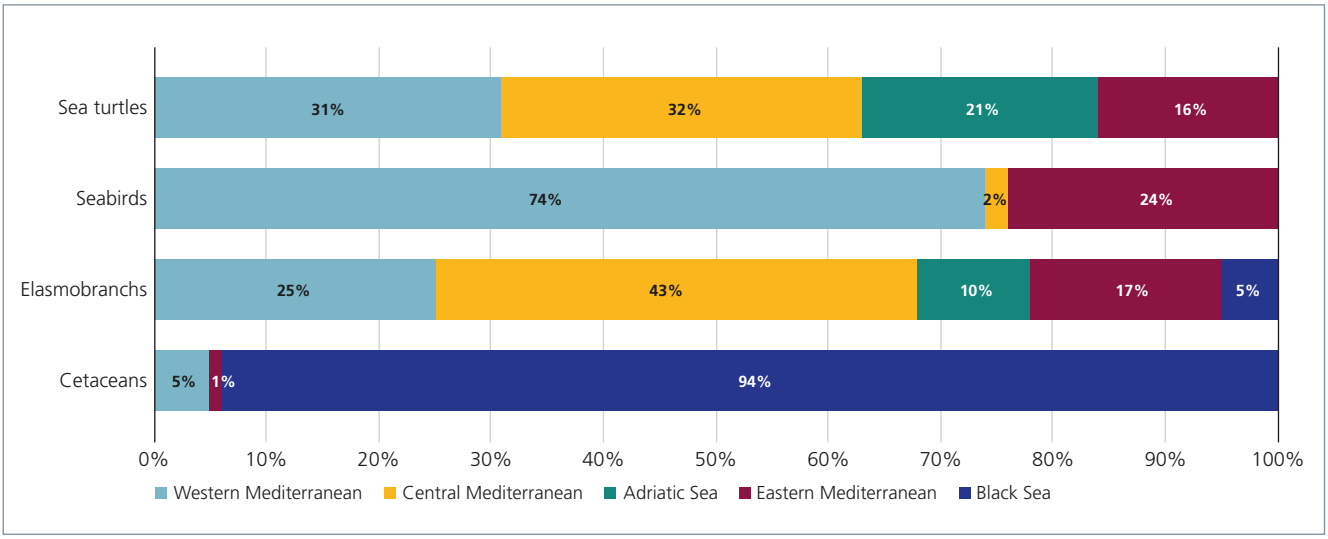


FIGURE 61. Relative contributions of GFCM subregions to the total incidental catch of vulnerable species groups in the GFCM area of application, 2000–2022



Concerning the spatial distribution of reported incidental catch in the region, the bulk of information (i.e. the number of individuals bycaught during fishing operations) is equally distributed between the western (around 161 000 individuals) and central Mediterranean (around 164 000 individuals). Information is more scattered in the Adriatic Sea (around 102 000 individuals) and the eastern Mediterranean (around 81 000 individuals), and in the Black Sea it is limited to only cetaceans (9 159 individuals) and elasmobranchs (2 074 individuals).

Elasmobranchs

Based on available data, trawlers and longliners have been responsible for the bulk of elasmobranch incidental catch, accounting for 15 360 and 13 998 individuals, respectively, across all subregions combined (Figure 63). Bycatch information mainly came from the central (17 203 individuals) and western Mediterranean (10 289 individuals), whereas lower incidences were reported from the eastern Mediterranean (6 743 individuals), the Adriatic Sea (3 944 individuals) and the Black Sea (2 074 individuals).

In the western Mediterranean, Spanish bottom trawlers and demersal longliners reported the highest number of interactions – 6 575 and 1 385 individuals, respectively (Figure 62). In the central Mediterranean, the current data suggest a more significant impact (mainly in Tunisian waters) of longliners (including demersal and pelagic) and bottom trawlers, reporting bycatch of 10 124 and 1 142 individuals, respectively. The little available data from the Adriatic Sea suggest that both Italian pelagic and bottom trawlers, reporting bycatch of 2 829 and 859 individuals, respectively, are the vessel groups causing the

FIGURE 62. Main vessel groups responsible for significant elasmobranch incidental catch by GFCM subregion

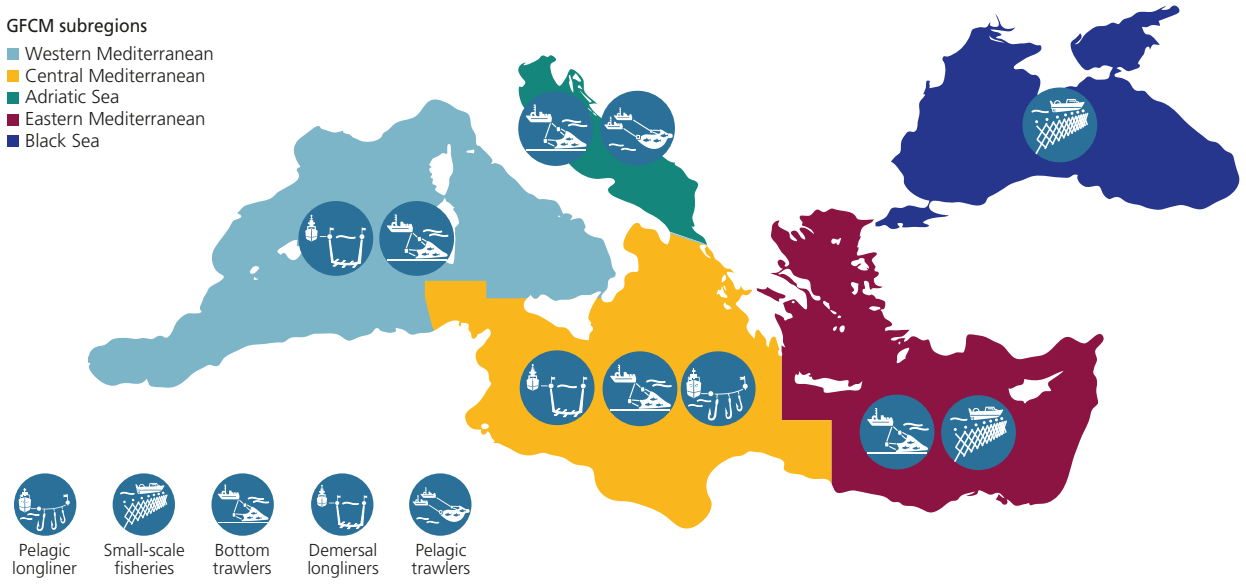
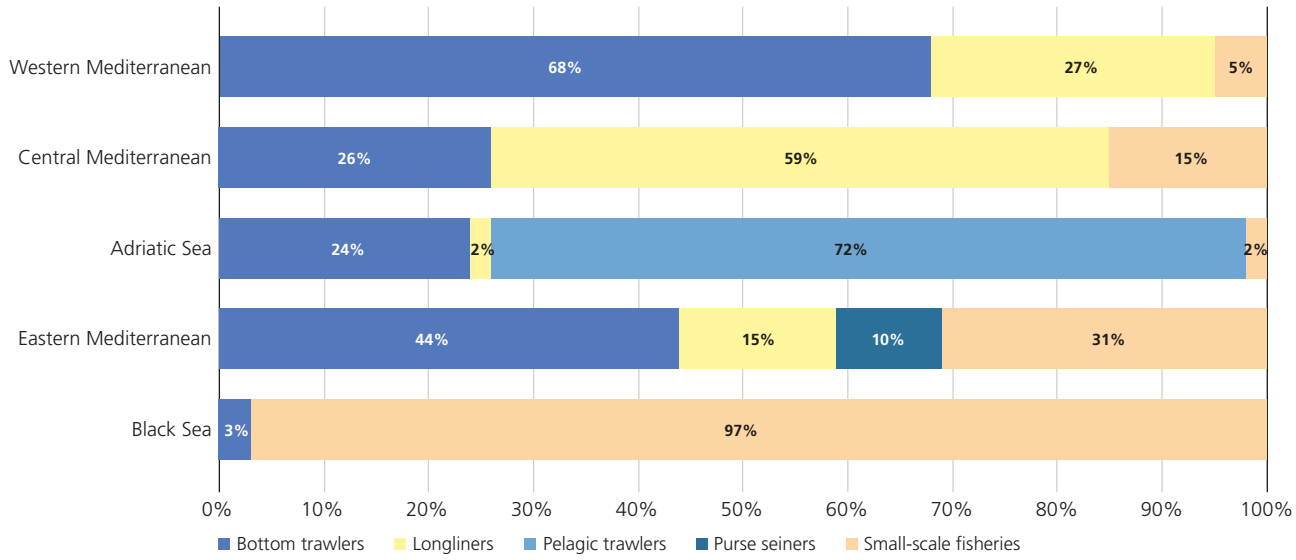


FIGURE 63. Relative contributions of vessel groups to the total incidental catch of elasmobranchs by GFCM subregion, 2000–2022



Note: Analysis carried out on around 40 000 individuals.

greatest impact. The data from the eastern Mediterranean indicates that Greek and Turkish bottom trawlers, with bycatch of 1 147 and 973 individuals, respectively, as well as Syrian small-scale fisheries (1 403 individuals), are the vessel groups with the highest reported interactions. Likewise, small-scale fisheries are responsible for the bulk of incidental catch in the Black Sea (2 009 individuals).

Sea turtles

Most incidental catch of sea turtles occurs in fisheries using bottom trawls and longlines (Figure 64), which account for 181 393 and 172 682 individuals, respectively, as well as in small-scale fisheries (83 274 individuals). Spanish, Moroccan and Italian longliners, with reported bycatch of 58 351, 18 873 and 13 133 individuals, respectively, represent the major vessel group interacting with sea turtles in the western Mediterranean. In the Adriatic Sea, trawlers are the vessel group for which the most information on sea turtle bycatch is reported (75 418 individuals). Similarly, this vessel group is reported to have the most impact also in the central Mediterranean (75 200 individuals), where the trawler fleets from Tunisia, Italy and Libya have contributed the highest numbers of incidentally caught sea turtles – 41 313, 23 130 and 7 205 individuals, respectively. Likewise, in the same area (central Mediterranean), Italian and Libyan longliners (including both demersal and pelagic), accounting for 17 338 and 19 240 individuals, respectively, represented other important fishing activities interacting negatively with sea turtles. The situation is more heterogeneous in the eastern Mediterranean, where countries' bottom trawl fleets recorded the following numbers of interactions with sea turtles: Türkiye (6 988); Greece (5 681); Egypt (3 894); and Israel (1 206). For longliners, the reported numbers were: Türkiye (9 728); Greece; (7 196); and Egypt (6 379). Finally, small-scale fisheries reported the following numbers: Türkiye (10 603), Cyprus (7 718), Egypt (7 264), Greece (5 347), Israel (1 672); and the Syrian Arab Republic (875). The presence of sea turtles is not confirmed in the Black Sea. Figure 65 shows the percentage contributions of each main vessel group to sea turtle incidental catch in the GFCM subregions.

FIGURE 64. Main vessel groups responsible for significant sea turtle incidental catch by GFCM subregion

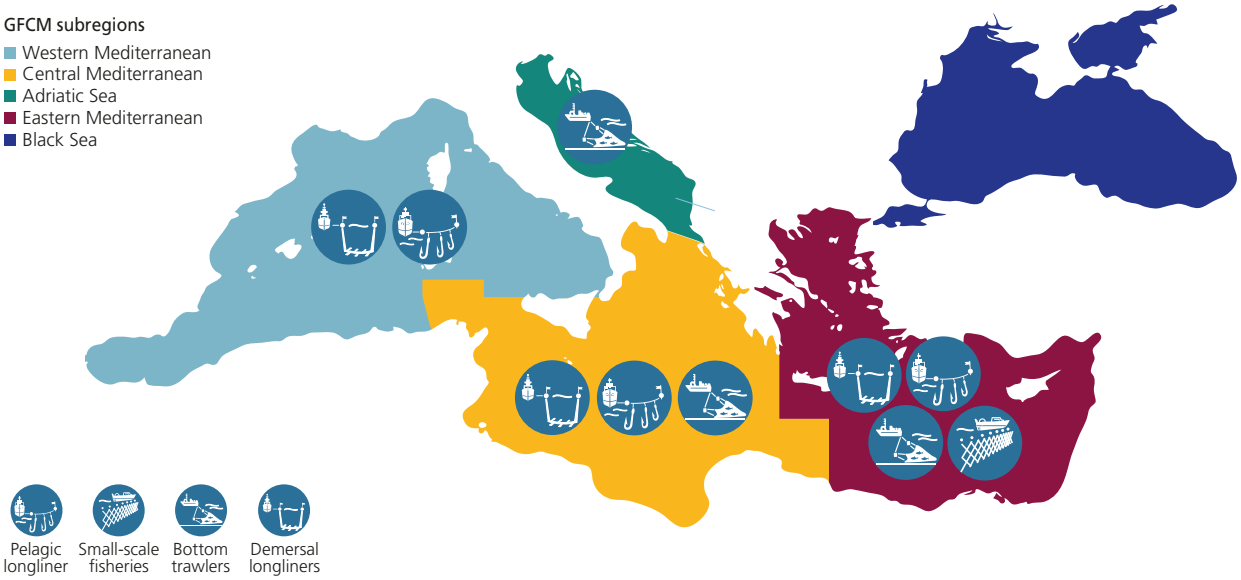
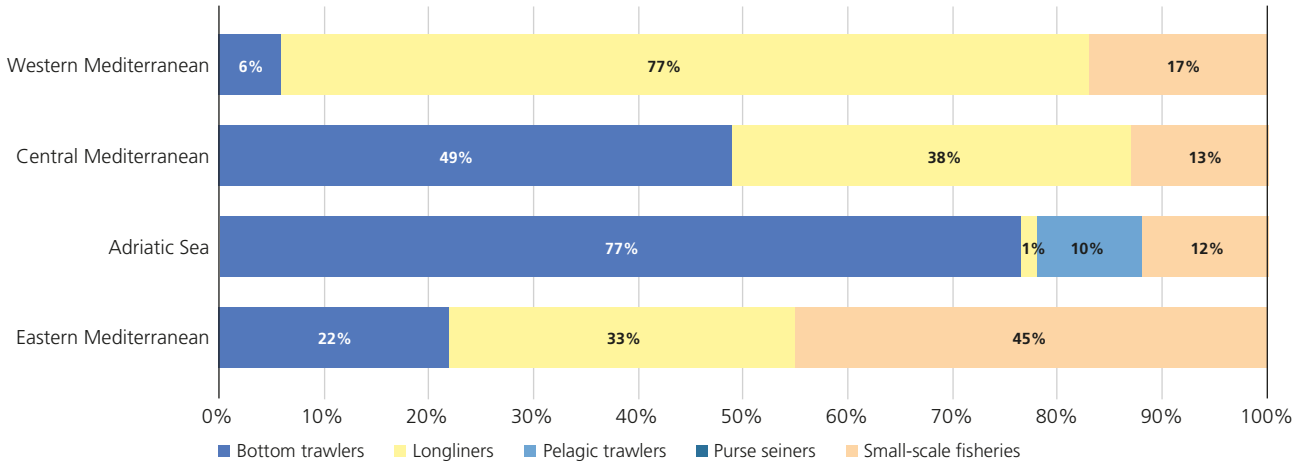


FIGURE 65. Relative contributions of vessel groups to the total incidental catch of sea turtles by GFCM subregion, 2000–2022



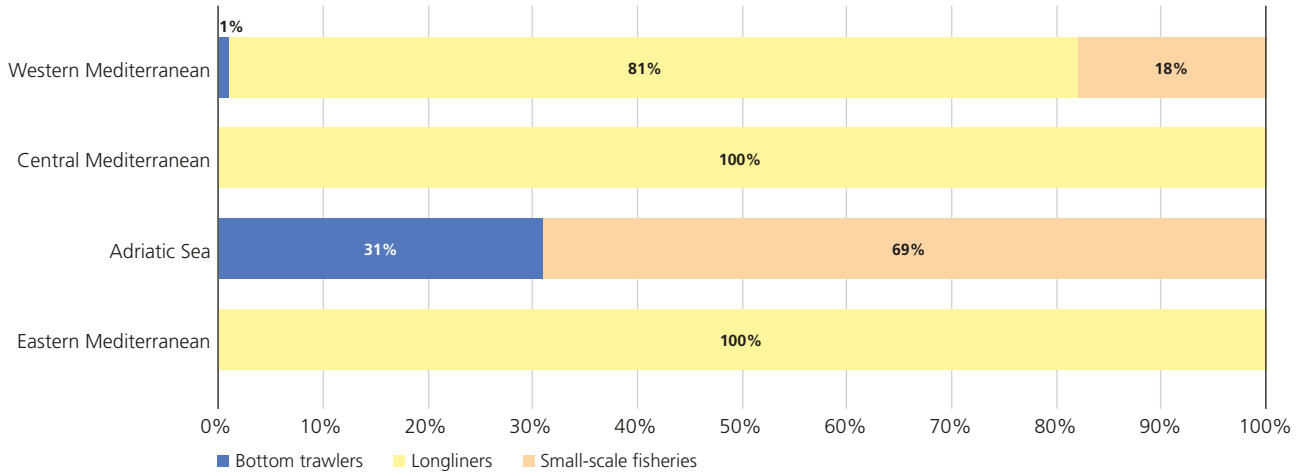
Note: Analysis carried out on around 470 000 individuals.

Seabirds

The data available on seabird incidental catch derive mainly from the western Mediterranean and are mostly reported by Spanish small-scale longliners (both demersal and pelagic), with a reported bycatch of 4 149 individuals (Figure 66). These interactions occur in coastal zones close to important breeding sites; for example, the Balearic Islands are considered to be a hotspot for the presence of breeding sites. In the same area, small-scale fisheries have produced a large component of incidental seabird catch (947 individuals). Demersal longliners operating in Türkiye and Greece report a seabird bycatch of 1 190 and 500 individuals, respectively, and appear responsible for the incidental capture of different species of vulnerable seabirds, including European shag (*Gulosus aristotelis desmarestii*),

FIGURE 66. Main vessel groups responsible for significant seabird incidental catch by GFCM subregion

FIGURE 67. Relative contributions of vessel groups to the total incidental catch of seabirds by GFCM subregion, 2000–2022

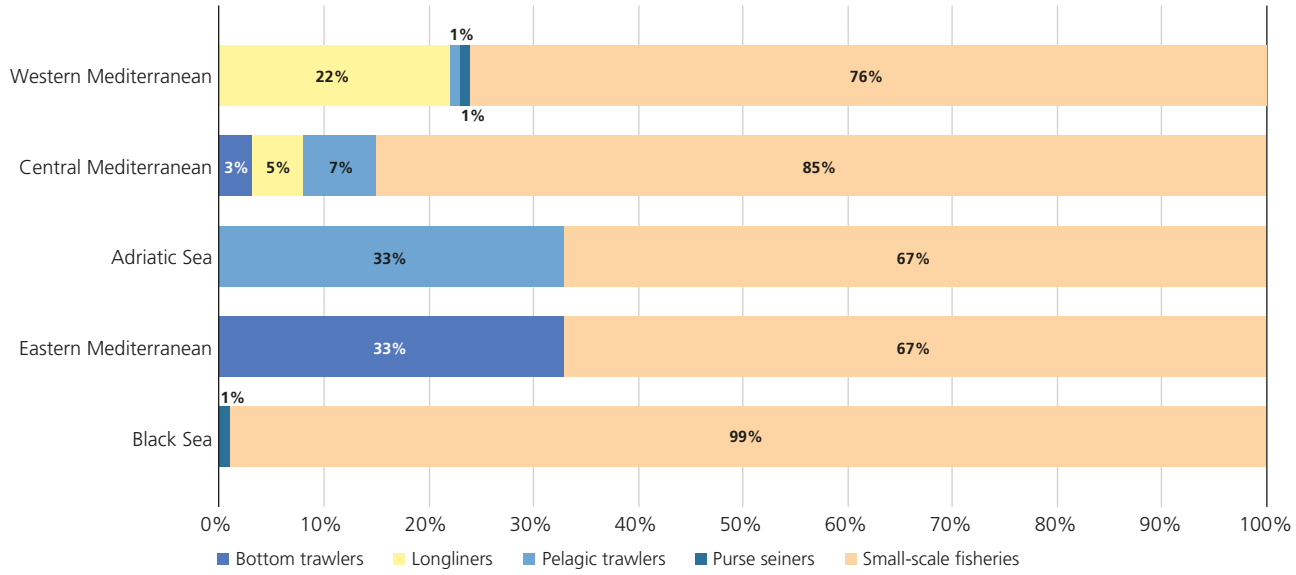


Notes:
Analysis carried out on around 8 000 individuals.
Percentages for the central Mediterranean, Adriatic Sea are based on few records.

Scopoli's shearwater (*Calonectris diomedea*), Yelkouan shearwater (*Puffinus yelkouan*) and Balearic shearwater (*Puffinus mauretanicus*). In the central Mediterranean, some data on seabird bycatch are derived from pelagic and demersal longliners operating mainly in Maltese waters (146 individuals). In the Adriatic Sea, only 13 individuals have been reported as seabird bycatch resulting from interactions with bottom trawlers and small-scale fisheries. Very few records come from southern Mediterranean countries, while no records could be found for the Black Sea (Figure 67).

FIGURE 68. Main vessel groups responsible for significant cetacean incidental catch by GFCM subregion

FIGURE 69. Relative contributions of main vessel groups to the total incidental catch of cetaceans by GFCM subregion, 2000–2022



Notes:
Analysis carried out on around 10 000 individuals.
Percentages for the central Mediterranean, Adriatic Sea and eastern Mediterranean are calculated based on few records.

Cetaceans

Small-scale fisheries using set gillnets and trammel nets in coastal areas have shown the greatest rates of interactions with cetaceans in all subregions (9 531 individuals) (Figure 69). The majority of data are reported from the Black Sea (9 159 individuals), where coastal fisheries targeting Black Sea turbot (*Scophthalmus maximus*) continue to have an impact on the cetacean population – which is composed of three endemic species, Black Sea common dolphin (*Delphinus delphis ponticus*), Black Sea bottlenose dolphin (*Tursiops truncatus ponticus*) and the most impacted, Black Sea harbour porpoise (*Phocoena phocoena relicta*).

A smaller number of records come from the western Mediterranean, with Morocco and France recording 236 and 164 individuals, respectively (Figure 68). Few data are reported from the other subregions. The overall reported incidental catch records (298 individuals) of other vessel groups (bottom trawlers, pelagic trawlers, purse seiners) presented lower values but cannot be considered negligible.

Final considerations on the incidental catch of vulnerable species

With the objective of establishing a baseline for the incidental catch of vulnerable species in the Mediterranean and the Black Sea and identifying priority areas in terms of management and conservation, the information gathered up to now – especially over the last twenty years – allows only for an outline of the hotspot areas where interactions between vulnerable species and fishing activities have been reported most frequently. The geographical and historical coverage of the data analysed is highly variable, covering neither all areas nor all vessel groups. Therefore, the data presented in this chapter greatly underestimate the actual frequency of incidental catch of vulnerable species in the GFCM area of application. The analysis also highlights the general difficulties in obtaining solid estimates of the incidental catch of vulnerable species, as the available information is subject to a number of shortcomings (e.g. lack of onboard observer programmes, species identification issues, inadequate spatial and temporal coverage), all of which add to uncertainty. However, despite the scattered nature of the data, it is clear that the scale and dimension of the incidental catch of vulnerable species in the

Mediterranean and the Black Sea is not negligible, especially for certain species in specific areas and for some vessel groups and types of gear.

Some places, such as the Balearic Islands, can be considered potential hotspots for the incidental catch of sea turtles or seabirds. For sea turtles, incidental catch estimates and associated mortality rates show great variability not only between subregions and vessel groups, but also within the same areas from year to year, which may result mainly from a lack of standardization in the frequency, temporal scale and type of data collected. Nevertheless, the current data have allowed for the identification, by area, of some of the vessel groups most responsible for negative interactions between sea turtles and different fishing activities (e.g. demersal and pelagic longliners in the western, central and eastern Mediterranean; bottom trawlers in the Adriatic Sea and central and eastern Mediterranean; and small-scale fisheries in the eastern Mediterranean).

For elasmobranchs, data gaps are larger, as incidental catch is likely not recorded at all, and available information remains extremely sparse for many reasons, including the fact that some species are commercialized while others are protected. From the available data, they appear sometimes to be caught in high numbers along with target species – or potentially in greater numbers or biomass than target species, such as in the case of piked dogfish (*Squalus acanthias*) and thornback ray (*Raja clavata*) in the Black Sea – and either discarded at sea or retained and landed for sale, including protected elasmobranch species. The data used for this overview may indicate that, by area, some vessel groups (e.g. bottom trawlers in almost all the subregions; demersal longliners in the western and central Mediterranean; pelagic longliners in the central Mediterranean; small-scale fisheries in the eastern Mediterranean and the Black Sea) may have a greater impact on elasmobranchs than other vessel groups, but this difference may mostly result from the variable availability of data from the different GFCM subregions. However, despite the low levels of reported incidental catch, sharks and rays are probably the vulnerable species most affected by fisheries.

Cetaceans have been highly impacted by Mediterranean and Black Sea fishers using pelagic drift nets since the early years of the nineteenth century. It is evident that the banning of drift nets in the early 2000s had positive and tangible effects on considerably reducing cetacean incidental catch. Since then, studies report a decline in the incidental capture of cetaceans (Carpentieri *et al.*, eds, 2021), while it can be inferred that other human-induced stressors (e.g. pollution, underwater noise, plastics and microplastics) may have a relatively greater impact on Mediterranean populations. In the Black Sea, on the other hand, the status of the populations of the three subspecies of harbour porpoise and of common dolphin and bottlenose dolphin appear to be of concern. Even if current data overestimate cetacean bycatch when extrapolated in relation to fishing effort and vessel groups for the Black Sea, urgent management measures aimed at ensuring both lower incidental catch and mortality rates should be immediately put in place.

More systematic data collection and studies should be carried out regularly throughout the entire basin, with a view to accurately recording the nature and extent of incidental catch and related mortality rates of vulnerable species (Box 12). Monitoring programmes, following standard protocols (e.g. Carpentieri, 2019b) can contribute to better understanding the different types of impacts, filling knowledge gaps and indicating which types of fishing gear are most harmful and whether fishing patterns reveal any geographical or seasonal trends. This information may, in turn, be useful in applying adequate mitigation measures in order to reduce the fishing industry's negative impacts on marine living resources and to ensure the survival of Mediterranean and Black Sea vulnerable populations.

Box 12. Addressing interactions between vulnerable species and fisheries

Understanding interactions between vulnerable species (sea turtles, marine mammals, seabirds, elasmobranchs and macrobenthic invertebrates) and fisheries – including both incidental catch and depredation – and adopting effective measures to minimize them are essential steps in the journey towards protecting biodiversity and guaranteeing sustainable fisheries and livelihoods.

The MedBycatch and Depredation projects

Efficiently promoting profitable fisheries while ensuring the conservation of vulnerable species calls for tight collaboration mechanisms between relevant organizations to create positive synergies and opportunities. The GFCM has implemented joint multipartner, multidisciplinary projects over the 2017–2022 period aimed at capitalizing on the complementarities between different organizations' mandates to better monitor and mitigate negative interactions between fisheries and vulnerable species.

The **MedBycatch project** ran from the end of 2017 to 2022, with the aim of improving the monitoring and mitigation of incidental capture of vulnerable species in fisheries (also known generically as bycatch), which represents a key conservation and sustainability issue in the Mediterranean for a number of taxonomic groups, namely sea turtles, marine mammals, seabirds, elasmobranchs and macrobenthic invertebrates. The project's regional scope also included field activities in five focus countries in the Mediterranean.

The **Depredation project** was launched in 2018 with the objective of strengthening knowledge around and mitigating cetacean depredation, which occurs when cetaceans partially or completely remove catch from fishing gear and is a growing cause for concern in several Mediterranean fisheries. This kind of human–cetacean interaction, mainly involving bottlenose dolphins (*Tursiops truncatus*) and common dolphins (*Delphinus delphis*), can affect both the survival of wild dolphin populations and the livelihoods of fishers. The project focused on depredation in small pelagic purse seine fisheries in two countries, as well as in select small-scale fisheries.

Monitoring and mitigation efforts in the field

Addressing knowledge gaps and formulating national strategies to reduce bycatch and depredation starts on the ground, through systematic and standardized data collection, capacity building and testing potential solutions.

Resources for dissemination of best practices

Replicability and sustainability are key to inform future work across the region. A variety of resources were produced to improve awareness on the interactions between vulnerable species and fisheries, offering the tools for a harmonized basis of knowledge, information and evidence for decision-making, including:

- two methodologies for data collection to ensure minimum common standards and allow for comparisons among fisheries;[1, 2]

[1] **Carpentieri, P.** 2019. *Monitoring the incidental catch of vulnerable species in Mediterranean and Black Sea fisheries: Methodology for data collection*. FAO Fisheries and Aquaculture Technical Paper No. 640. Rome, FAO. https://www.fao.org/3/ca4991en/ca4991en.pdf

[2] **Carpentieri, P. & Gonzalvo, J.** 2022. *Dolphin depredation in Mediterranean and Black Sea fisheries: Methodology for data collection*. FAO Fisheries and Aquaculture Technical Paper No. 688. Rome, FAO. https://doi.org/10.4060/cc2943en

GFCM multipartner projects

Projects	
MedBycatch project "Understanding Mediterranean multi-taxa bycatch of vulnerable species and testing mitigation – a collaborative approach"	Depredation project "Mitigating dolphin depredation in Mediterranean fisheries – Joining efforts for strengthening cetacean conservation and sustainable fisheries"
Partners	
■ Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS) ■ General Fisheries Commission for the Mediterranean (GFCM) ■ Specially Protected Areas Regional Activity Center (SPA/RAC) of the Mediterranean Action Plan of the United Nations Environment Programme (UNEP/MAP) ■ International Union for Conservation of Nature – Centre for Mediterranean Cooperation (IUCN-Med) ■ BirdLife Europe and Central Asia (BL ECA) ■ Mediterranean Association to Save the Sea Turtles (MEDASSET) ■ World Wildlife Fund – Mediterranean Marine Initiative (WWF)	■ Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS) ■ General Fisheries Commission for the Mediterranean (GFCM) ■ Specially Protected Areas Regional Activity Center (SPA/RAC) of the Mediterranean Action Plan of the United Nations Environment Programme (UNEP/MAP) ■ Low Impact Fishers of Europe (LIFE)

Box 12 (continued)

GFCM monitoring programmes

Field work

Bycatch monitoring programme
Croatia, Italy, Morocco, Tunisia, Türkiye

- 80+ ports surveyed;
- 50+ observers trained;
- 5000+ onboard observations;
- 17500+ port-based questionnaires:
- 10 different science-based mitigation measures (e.g. spatio-temporal closures, applied technology) tested; and
- complementary studies, advocacy and awareness campaigns.

Cetacean monitoring programme
Italy, Malta, Morocco, Tunisia, Spain

- multidisciplinary and systemic approach to monitoring interactions: observations made both on board (floating laboratories) and with a research vessel (sentinel), questionnaires issued at port, cameras on fishing nets used;
- combination of mitigation techniques: a new type of strengthened net tested in Moroccan purse seiners, as well as an alarm system, pingers and other deterrent devices;
- study on the socioeconomic impacts of depredation conducted; and
- awareness materials disseminated.

- two reviews of available information to provide a baseline and identify knowledge gaps;[3, 4]
- guides available in up to eight languages to support fishers and scientific observers in the case of bycatch events, including:
  - identification guides of Mediterranean vulnerable species, including pocket guides by subregion, to recognize species and determine their conservation status;[5] and
  - good practice guides for the safe handling of species incidentally caught in the Mediterranean to promote responsible fishing practices;[6, 7, 8, 9] and
- other resources to support improved knowledge and the identification of solutions, including:
  - training workshops on photo identification and line transect surveys to support the study of dolphin population dynamics;
  - training courses on the identification and handling of vulnerable species incidentally caught during fishing operations;
  - subregional trainings on data collection methodologies; and
  - ad hoc studies on complementary topics (socioeconomic impacts, post-release mortality, co-management schemes, etc.).

Scaling up findings into scientific advice

The GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Black Sea (see Box 1) aims to ensure adequate monitoring of interactions between vulnerable species and fisheries, as well as systematic testing and implementation of mitigation and selectivity measures to reduce incidental catch and depredation, including in the context of a regional plan of action for vulnerable species. Capitalizing on the experience gained through monitoring programmes, the GFCM – in collaboration with relevant partners – will further data collection and establish ad hoc pilot projects for select vulnerable species in hotspot areas, with a view to integrating results into the advisory process. The improved quality of the advice provided will underpin strengthened technical and nature-based solutions to conserve biodiversity and enhance the productivity of marine living resources, reinforcing decision-making for sustainable Mediterranean and Black Sea fisheries.

[3] **Carpentieri, P., Nastasi, A., Sessa, M. & Srour, A., eds.** 2021. *Incidental catch of vulnerable species in Mediterranean and Black Sea fisheries: A review*. Studies and Reviews No. 101 (General Fisheries Commission for the Mediterranean). Rome, FAO. https://doi.org/10.4060/cb5405en

[4] **Gonzalvo, J. & Carpentieri, P. eds.** (forthcoming). *Cetacean depredation from fishing gear in the Mediterranean Sea, Black Sea and contiguous Atlantic area: a review*. GFCM Studies and Reviews. Rome, FAO.

[5] **Otero, M., Serena F., Gerovasileiou, V.,Barone, M., Bo, M., Arcos, J.M., Vulcano A. & Xavier, J.** 2019. *Identification guide of vulnerable species incidentally caught in Mediterranean fisheries*. IUCN, Malaga, Spain.

[6] **FAO and ACCOBAMS.** 2019. *Good practice guide for the handling of cetaceans caught incidentally in Mediterranean fisheries*. General Fisheries Commission for the Mediterranean. Rome, FAO. http://www.fao.org/3/ca0015en/CA0015EN.pdf

[7] **FAO and ACCOBAMS.** 2019. *Good practice guide for the handling of sea turtles caught incidentally in Mediterranean fisheries*. General Fisheries Commission for the Mediterranean. Rome, FAO. http://www.fao.org/3/i8951en/I8951EN.pdf

[8] **FAO and ACCOBAMS.** 2019. *Good practice guide for the handling of sharks and rays caught incidentally in Mediterranean pelagic longline fisheries*. General Fisheries Commission for the Mediterranean. Rome, FAO. http://www.fao.org/3/i9152en/I9152EN.pdf

[9] **FAO and ACCOBAMS.** 2019. *Good practice guide for the handling of seabirds caught incidentally in Mediterranean pelagic longline fisheries*. General Fisheries Commission for the Mediterranean. Rome, FAO. http://www.fao.org/3/i8937en/I8937EN.pdf

5. Status of fishery resources

Data for the assessment of fishery resources have been regularly collected through stock assessment forms (SAFs), which also contain information on biological reference points and the outcomes of validated assessments (e.g. modelled catch and estimates of fishing mortality, exploitation rates, spawning stock biomass and recruitment); detailed explanations on reference points are provided in Caddy and Mahon (1995). Since 2019, the numeric outputs of the assessments are also stored in the stock assessment results (STAR) framework, which was designed to facilitate more integrated analyses of assessment results. Consistent with the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a), the analysis presented in this chapter is based on the SAF and STAR databases 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) from 2008 to 2020, while excluding assessments considered to be preliminary and not yet resulting in advice. Up to 2018, all advice on the status of fishery resources within the GFCM was provided based on two-year-old data (Box 15). Since 2018, a system of benchmarking assessments and dedicated assessment sessions performed throughout the year (Box 15) has been adopted and has resulted in some advice being based on one-year-old data, e.g. all assessments in the Black Sea since 2019.

This chapter provides an overall analysis of the status of resources, carried out in relation to agreed reference points. These are mainly linked to indicators of fishing mortality – with the reference point being the fishing mortality (F) producing maximum sustainable yield (MSY), i.e. F_{MSY} or proxies for F_{MSY} – since just 18 percent of the assessed stocks in 2019 and 2020 have agreed biomass reference points (target, limit or precautionary biomass reference points). 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 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); and ii) the average fishing mortality over the last three years for demersal stocks assessed with backward methods (e.g. extended survivor analysis). 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). Whenever possible, information has been aggregated to provide a subregional and regional outline of the status of resources, using indicators agreed upon in the GFCM framework for the provision of advice. Fishing activity in 2020 was affected by the COVID-19 pandemic (see Box 10), which resulted in stock status and fishing mortality being subject to the impacts of fishing pressure fluctuations.

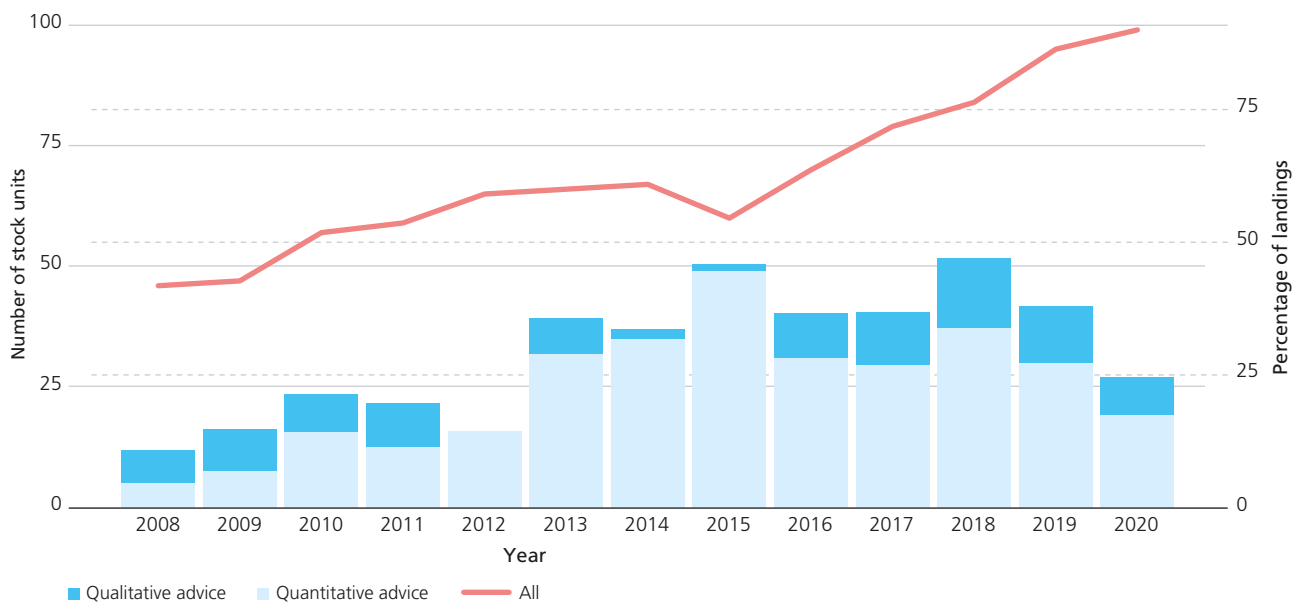
TABLE 13. Number of validated and non-deprecated stock assessments available per year, 2003–2020

Year	Validated assessments	Non-deprecated assessments
2003	1	1
2006	17	18
2007	27	32
2008	32	46
2009	28	47
2010	37	57
2011	25	59
2012	35	65
2013	29	66
2014	25	67
2015	38	60
2016	57	70
2017	56	79
2018	50	84
2019	71	95
2020	79	99

SPATIAL AND TEMPORAL COVERAGE OF ADVICE ON STOCK STATUS

The number of non-deprecated validated stocks increased progressively between 2006 and 2020, peaking in 2020 with 99 in total; of these, since 2018, more than 75 percent were carried out in the terminal year (i.e. less than 25 percent of the assessments used are more than one year old) (Table 13, reflecting an improvement in spatial and temporal coverage. The percentage of catch assessed by the Scientific Advisory Committee on Fisheries (SAC) and the Working Group on the Black Sea (WGBS) reached 53 percent in 2015 (Figure 70), fluctuating between 30 to 50 percent since then, mostly due to the percentage of catch of key Black Sea small pelagic species, e.g. Black Sea anchovy (*Engraulis encrasicolus ponticus*) and sprat (*Sprattus sprattus*), whose landings are around 200 000 tonnes and 64 000 tonnes in 2021, respectively. Pending the finalization of a benchmark process, the last validated assessment for Black Sea anchovy was carried out in 2017, and therefore this assessment is considered deprecated in 2020, causing the percentage of catch assessed to fall below 30 percent. The number of stocks for which advice was provided on a qualitative (precautionary) basis remained around 25 percent since the reference year 2018 (Figure 70), while the percentage of the catch assessed on a qualitative basis decreased from 14 percent to 8 percent over the same period.

FIGURE 70. Number of stock units and percentage of declared landings assessed per year, 2008–2020, with an indication of the quality of the advice 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 refers to validated advice on a precautionary basis, with no quantitative estimates.
Quantitative advice refers to advice based on quantitative estimates generated by stock assessments in terms of current fishing mortality and/*or* biomass and respective reference points.

FIGURE 71. Number of validated stock assessments per year by GFCM subregion, 2008–2020

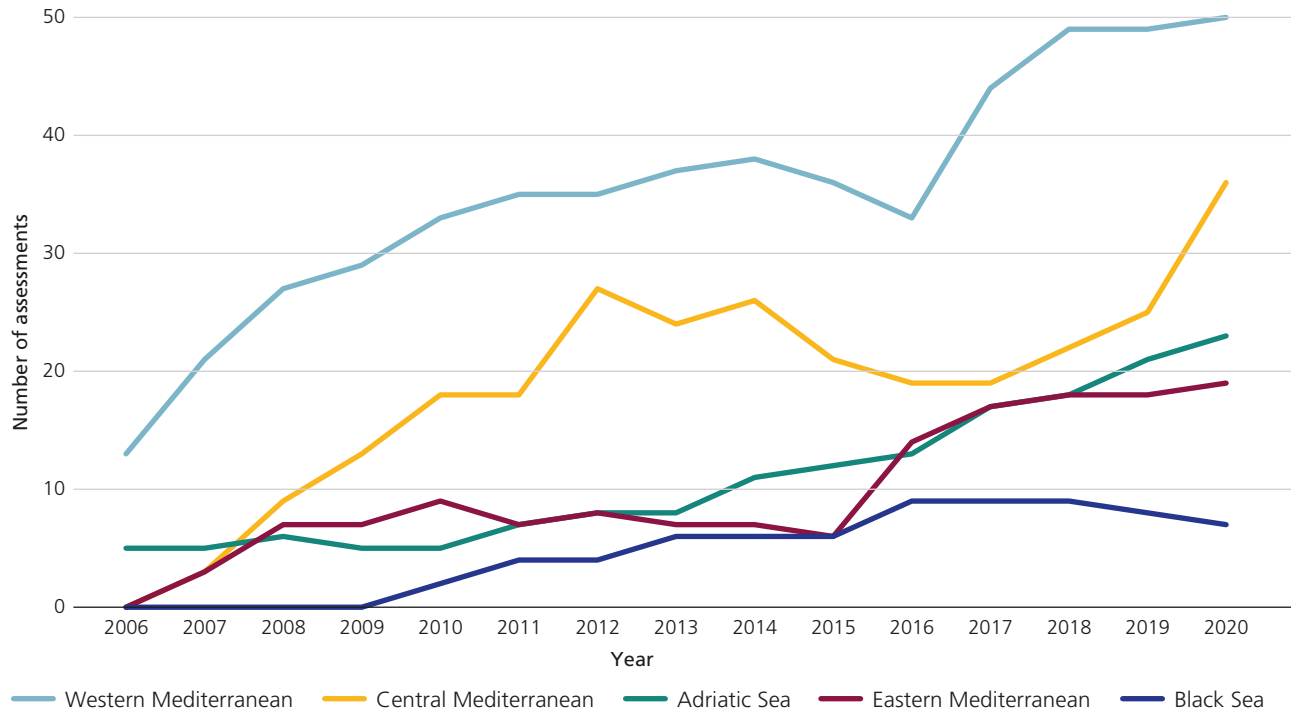
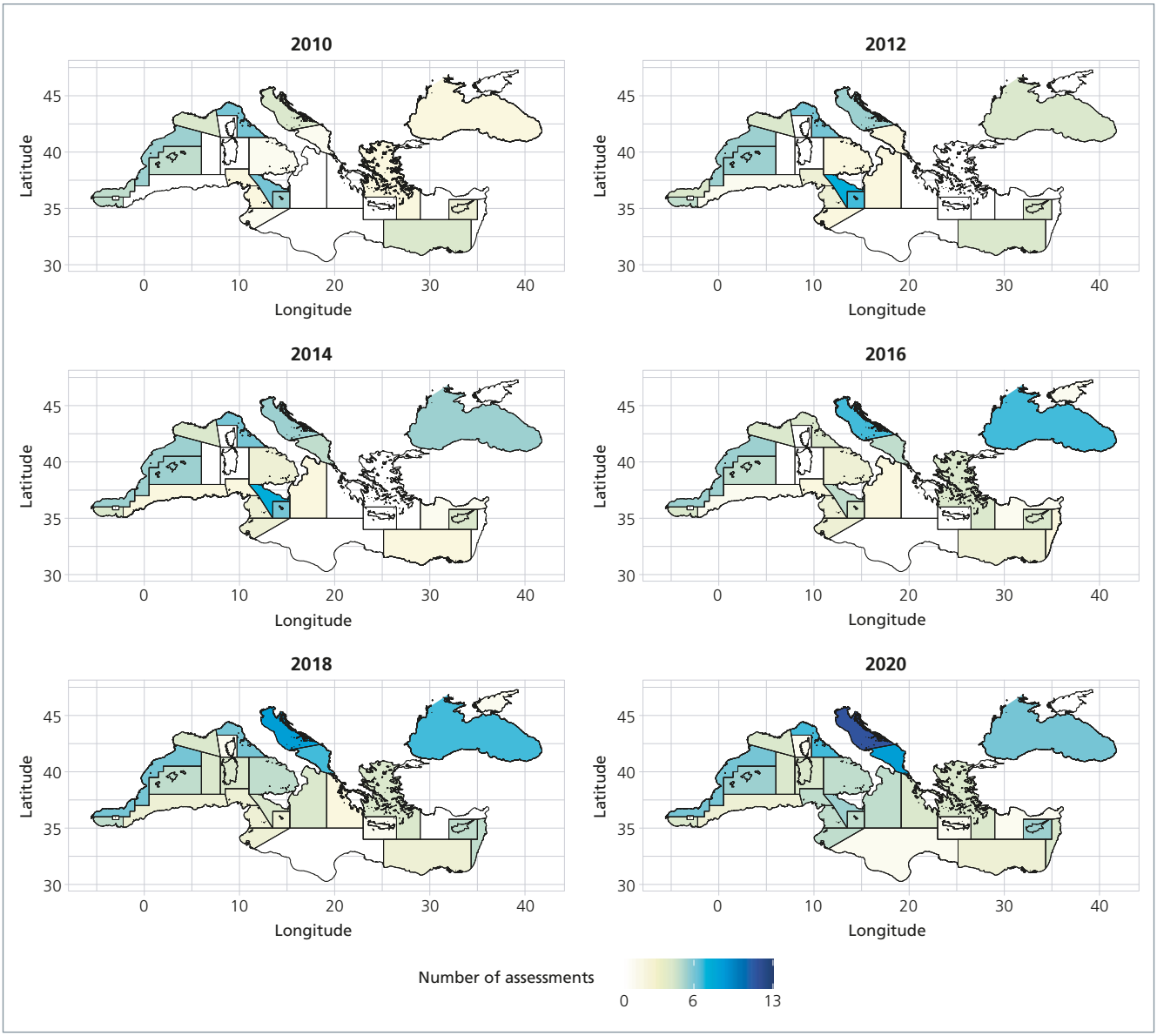


FIGURE 72. Number of validated stock assessments performed per two-year period by geographical subarea, 2010–2020

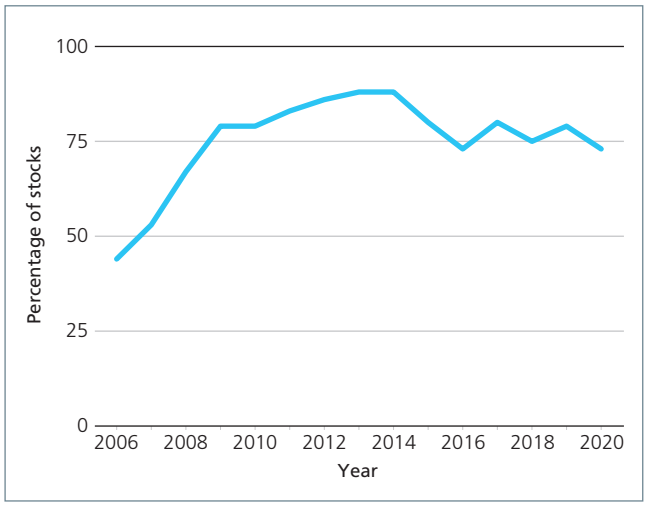


The overall increase in validated assessments compared to 2018 is consistent across all Mediterranean subregions. The central Mediterranean showed the steepest increase in the number of validated assessments since 2018 (Figure 71), although the degree of increase varied among geographical subareas (GSAs) in the subregion (Figure 72).

Coverage increased visibly in the central Mediterranean in GSAs 12–16 (northern Tunisia, Gulf of Hammamet, Gulf of Gabès, Malta and southern Sicily) and GSA 20 (eastern Ionian Sea) and in the Adriatic Sea (GSAs 17–18). Furthermore, GSA 5 (Balearic Islands), GSA 9 (Ligurian Sea and northern Tyrrhenian Sea), GSA 19 (western Ionian Sea), GSA 21 (southern Ionian Sea), GSA 24 (northern Levant Sea) and GSA 25 (Cyprus) increased by one stock assessed, between 2018 and 2020, bridging the gap between areas with low and high assessment coverage in the GFCM area of application (Figure 72). In contrast, GSA 29 (Black Sea) assessments decreased by one as the benchmark assessment of Black Sea anchovy was not finalized in 2020 (Figure 71 and Figure 72).

Coverage varied geographically for the different priority species. For European hake (*Merluccius merluccius*) and red mullet (*Mullus*

FIGURE 73. Percentage of stocks in overexploitation in the GFCM area of application, 2008–2020



barbatus), recent assessments exist for most management units, with coverage having improved since 2018, although it is still incomplete for European hake in the eastern Mediterranean (Table 14). Deep-water rose shrimp (*Parapenaeus longirostris*) also experienced excellent coverage in those subregions where it is a priority species, with few exceptions. Assessments of giant red shrimp (*Aristaeomorpha foliacea*) showed a high increase in coverage, having been evaluated for the first time in GSAs 12–16 and the western part of GSA 21 together. Surmullet (*Mullus surmuletus*) was also incorporated into assessments in GSA 5 (Balearic Islands), GSA 25 (Cyprus) and GSA 26 (southern Levant Sea).

Between the previous edition and current edition of *The State of Mediterranean and Black Sea Fisheries (FAO, 2016, 2018, 2020a)*, nine new stocks have been assessed: Horned octopus (*Eledone cirrhosa*) in GSA 18 (southern Adriatic Sea); blackbellied angler (*Lophius budegassa*) and great Mediterranean scallop (*Pecten jacobaeus*) in GSA 17 (northern Adriatic Sea); axillary seabream (*Pagellus acarne*) and comber (*Serranus cabrilla)* in GSA 25 (Cyprus); and sand steenbras (*Lithognathus mormyrus*), common pandora (*Pagellus erythrinus*) and goldband goatfish (*Upeneus moluccensis*) in GSA 27 (eastern Levant Sea) (Table 14). Regarding small pelagics, coverage increased as a result of stock assessments of sardine (*Sardina pilchardus*) in GSA 4 (Algeria) and GSA 9 (Ligurian Sea and northern Tyrrhenian Sea) and of European anchovy (*Engraulis encrasicolus*) GSA 20 (eastern Ionian Sea).

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

Biomass reference points are not commonly available for assessed stocks. Therefore, the percentage of stocks fished outside biologically sustainable limits is mainly estimated by comparing the level of fishing mortality to the fishing mortality reference point. Most stocks for which validated assessments are available continue to be fished outside biologically sustainable limits (Figure 73). Nevertheless, there has been a 10 percent decrease in the percentage of stocks in overexploitation since 2012; in 2020, 73 percent of stocks were found to be outside biologically sustainable limits (the same value as in 2016 and the lowest since 2009) (Figure 73).

Overall status of stocks: fishing mortality

Overall, fishing mortality for all species and management units combined continues to be more than twice the target (Table 15). However, there has been a 21 percent reduction in this ratio since 2012 (when it was nearly three times higher), with the current ratio (F/F_{MSY} = 2.25) representing the lowest of the time series (Figure 74). The highest average values of exploitation ratios are found for blue and red shrimp (*Aristeus antennatus*), followed by European hake and some small pelagic species, e.g. sardine (Table 15). Most of the highest values (i.e. fishing mortality higher than four times the value of F_{MSY}), have been found in the western Mediterranean for European hake, blue and red shrimp and red mullet.

European hake has experienced a very large reduction in F/F_{MSY} throughout the Mediterranean Sea, excluding in the western Mediterranean where some very high ratios are still found (Table 15, Figure 78). In detail, the average exploitation ratio (F/F_{MSY}) of European hake in the region has declined by 39 percent since 2013, although it remains on average four times higher than the reference point.

A total of 16 stocks show exploitation rates below F_{MSY} (although some show very low biomass and are still considered to be overexploited); of these, the majority are found in the western Mediterranean (eight), while the central Mediterranean and the Black Sea host only one stock each with exploitation rates below the reference point (Table 15).

TABLE 14. 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	19	20	21	17	18	22	23	24	25	26	27	28	29	30
Demersal species																														
European hake	2020		2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020	2020		2020	2020	2020								
Red mullet	2020					2020	2020		2020	2020		2020	2020	2020	2020	2020	2020	2020		2020	2020	2020		2020	2020				2020	
Deep-water rose shrimp	2020		2020	2020	2020	2020			2020	2020	2020	2020	2020	2020	2020	2020	2020			2020	2020									
Giant red shrimp									2020	2020	2020	2020	2020	2020	2020	2020	2020		2020		2020									
Blue and red shrimp	2020	2020			2020	2020			2020	2020	2020						2020				2020									
Norway lobster					2020	2020			2020																					
Surmullet					2020																				2020	2019				
Blackspot seabream	2020		2020																											
Whiting																													2020	
Rapa whelk																													2020	
Turbot																													2020	
Common cuttlefish																				2020										
Common sole																				2020										
Spottail mantis shrimp																				2020										
Purple dye murex																				2019										
Horned octopus																					2020									
Sand steenbras																											2019			
Blackbellied angler																				2019										
Axillary seabream																									2020					
Common pandora																											2019			
Great Mediterranean scallop																				2020										
Comber																									2020					
Goldband goatfish																											2018			
Small pelagic species																														
Sardine	2020		2020	2020		2020	2020		2020							2020		2020		2019	2019	2020								
European anchovy	2020					2020	2020		2020							2020		2020		2019	2019	2020							2020	2016
European sprat																													2020	
Mediterranean horse mackerel																													2020	
Round sardinella																											2016			
Species of regional importance																														
Common dolphinfish					2020							2020	2020	2020	2020															
Species of conservation concern																														
Piked dogfish																													2017	
European eel																														
Red coral			2003																											

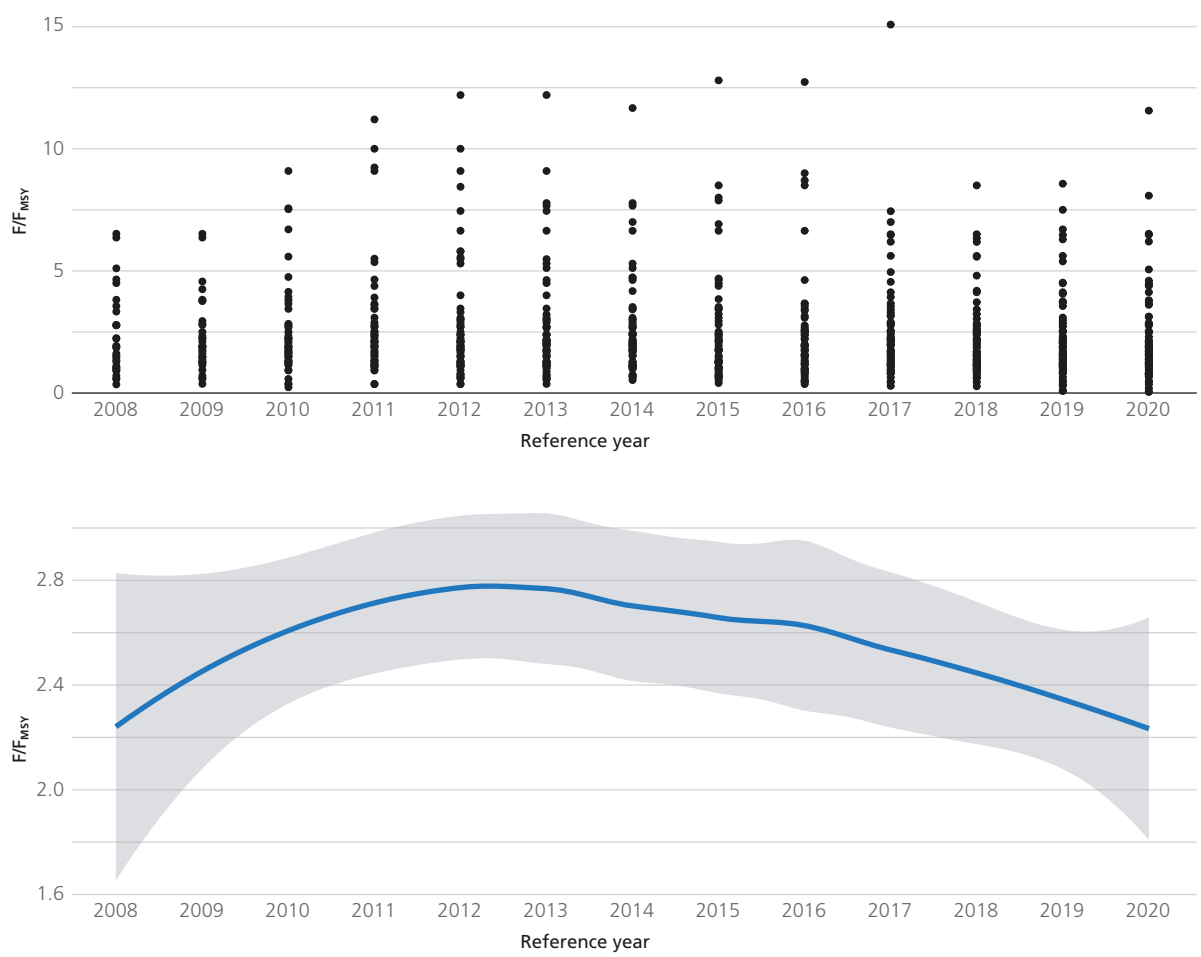
Note: Not all combinations of species and geographical subareas are considered as priority stocks (see Table 1 and Table 3).

TABLE 15. Exploitation ratios (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	4.41		8.08		4.41	4.41	4.41	3.12	3.12	3.12	3.12	1.24	1.24	1.24	1.24	1.24	1.86	1.86		2.47	2.47					4.13					3.01
Red mullet	6.48					5.06	1.37		0.71	0.78		3.13	3.13	3.13	1.95	0.81	1.87	1.1			0.96			1.42				1.27		2.21
Deep-water rose shrimp	1.73		2.14	2.14	2.07	1.6			1.22	1.22	1.22	1.34	1.34	1.34	1.34	1.34	2.3			2.3	2.3										1.68
Giant red shrimp									2.14	2.14	2.14						1.38				1.38										1.84
Blue and red shrimp	1.64	1.68			3.61	6.2			4.6	4.6	4.6																				3.85
Norway lobster					0.69	3.8			0.5											1.58	1.58										1.63
Surmullet					1.97																					3.7					2.84
Blackspot seabream	0.78		0.78																												0.78
Turbot																													1.75		1.75
Common cuttlefish																				1.17											1.17
Common sole																				0.81											0.81
Spottail mantis shrimp																	2.54			0.79	2.54										1.95
Purple dye murex																				1.08											1.08
Horned octopus																					0.77										0.77
Sand steenbras																											2.07				2.07
Axillary seabream																									1.05						1.05
Common pandora																									0.45		1.9				1.17
Great Mediterranean scallop																				2.86											2.86
Comber																									0.67						0.67
Goldband goatfish																															
Whiting																															
Rapa whelk																															
Peregrine shrimp																										2.85					2.85
Caramote prawn																				2.11											2.11
Brushtooth lizardfish																											1.87				1.87
Bogue																									1.2						1.20
Small pelagic species																															
Sardine			2.77			1.72	0.05		0.19							2.78				4.49	4.49										2.36
European anchovy							0.05		0.35							1.55				1.51	1.51										0.99
European sprat																													0.9		0.90
Mediterranean horse mackerel																															
Round sardinella																															
Species of regional importance																															
Common dolphinfish																															
Species of conservation concern																															
Piked dogfish																															
European eel																															
Red coral																															

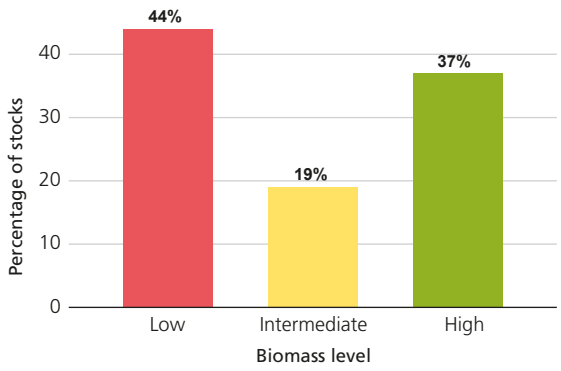
Note: Ratios of stocks in sustainable exploitation are highlighted in green.

FIGURE 74. Exploitation ratios (F/F_{MSY}) of all species and management units, 2008–2020



Notes:
The top panel shows individual relative status per year based on fishing mortality (F).
The bottom panel shows the average trend (using LOESS smoother) for all stocks, including non-deprecated stocks, with the shaded area representing the standard error.

FIGURE 75. Percentage of Mediterranean stocks at low, intermediate and high relative biomass levels

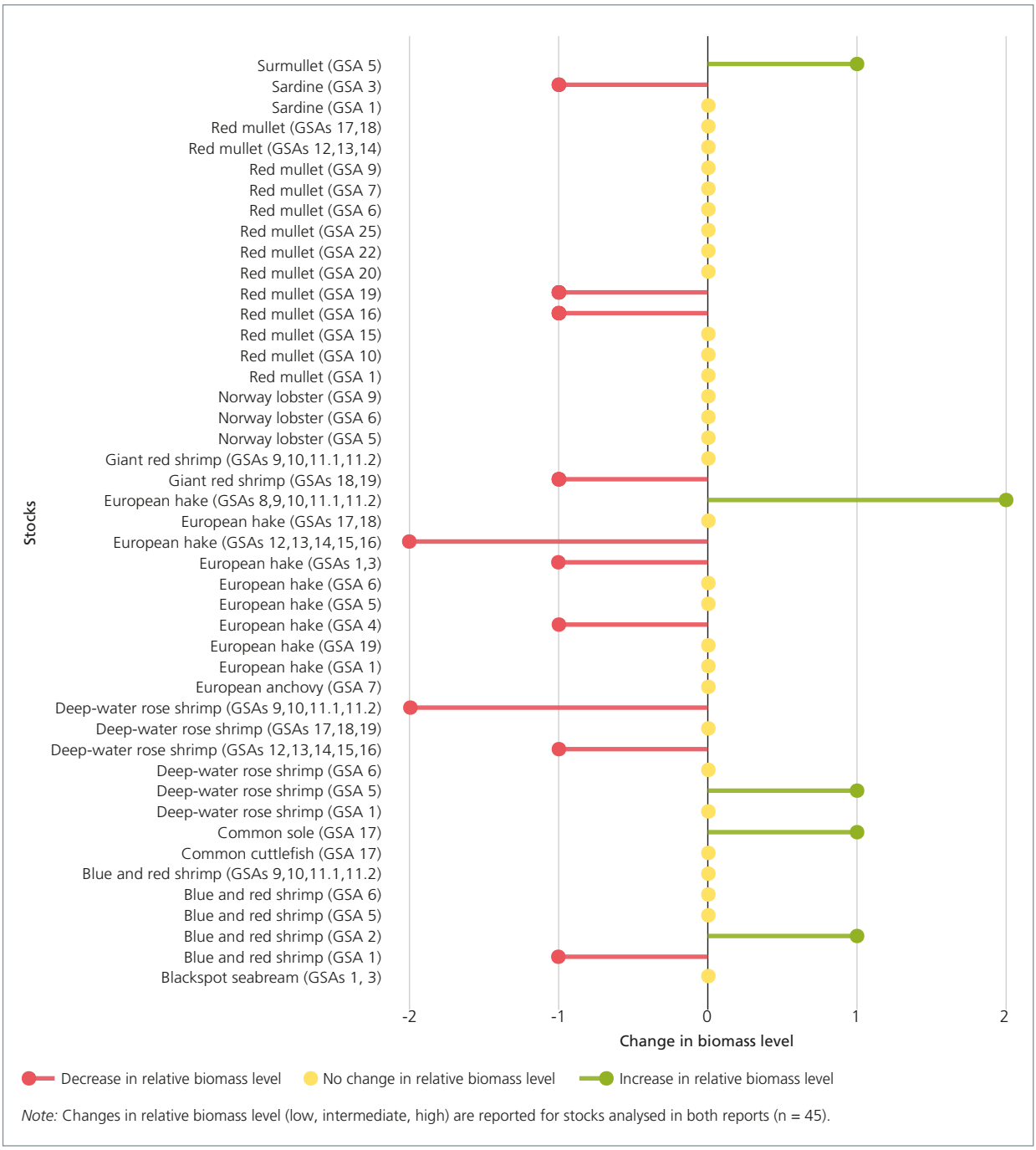


Note: Based on information available for 67 stocks covering 23 geographical subareas and 16 species.

Overall status of stocks: biomass

Although it continues 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 biomass provided by some of the stock assessment models. In the reference year 2020, estimates of biomass values are available for a total of 67 Mediterranean stocks, of which only 14 have biomass reference points, and very few are available for Black Sea stocks. This number includes several new stocks whose biomass levels were not analysed in previous editions of *The State of Mediterranean*

FIGURE 76. Comparison of biomass levels between the previous and current edition of *The State of Mediterranean and Black Sea Fisheries*



Note: Changes in relative biomass level (low, intermediate, high) are reported for stocks analysed in both reports (n = 45).

and Black Sea Fisheries (FAO, 2020a);[11] therefore, the results are not directly comparable.

The analysis undertaken in this section does not include the Black Sea and uses both stocks with reference points and those without. For those stocks with reference points for biomass available, the current biomass of horned octopus, common sole (*Solea solea*), common cuttlefish (*Sepia officinalis*) and great Mediterranean scallop (*Pecten jacobaeus*) in GSAs 17–18 (northern and southern Adriatic Sea), axillary seabream in GSA 25 (Cyprus), European hake in GSAs 12–16 (central Mediterranean) and sardine and anchovy in GSA 9 (Ligurian Sea and northern Tyrrhenian Sea) were compared to the biomass at MSY (B_{MSY})

[11] The State of *Mediterranean and Black Sea Fisheries 2020* analysed 51 stocks spread across 82 management units.

reference point. For European hake in GSAs 17–18 (northern and southern Adriatic Sea), turbot (*Scophthalmus maximus*) in GSA 29 (Black Sea), sardine and anchovy in GSA 7 (Gulf of Lion), the biomass precautionary reference point (B_{PA}) and limit reference point (B_{LIM}) were considered. The biomass of blackspot seabream in GSAs 1 and 3 (northern and southern Alboran Sea) was compared using only B_{Lim}. Recently, the biomass corresponding to 40 percent of the unfished biomass ($B_{40\%}$) was used as a reference point for the spottail mantis shrimp in GSA 17 (northern Adriatic Sea).

In all cases, values above the reference point were considered high and those below the reference point considered low. For demersal stocks without reference points, biomass is classified as high, intermediate or low by comparing the current estimate with the 66th and 33rd percentiles of the available time series. Consequently, while the number of stocks with estimated biomass reference points has increased since the last edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a), most information is still derived from available time series, and emerging results should be considered as relative and pending a full quantitative analysis. In addition, the STAR framework has produced much more detailed information available for the reference year 2020, thus limiting comparability with the biomass analyses carried out in the previous edition (FAO, 2020a).

The overall analysis of the current biomass levels of Mediterranean stocks reveals a prevalence of stocks with relatively low biomass, although the percentage remains lower than the sum of the intermediate and high biomass percentages.

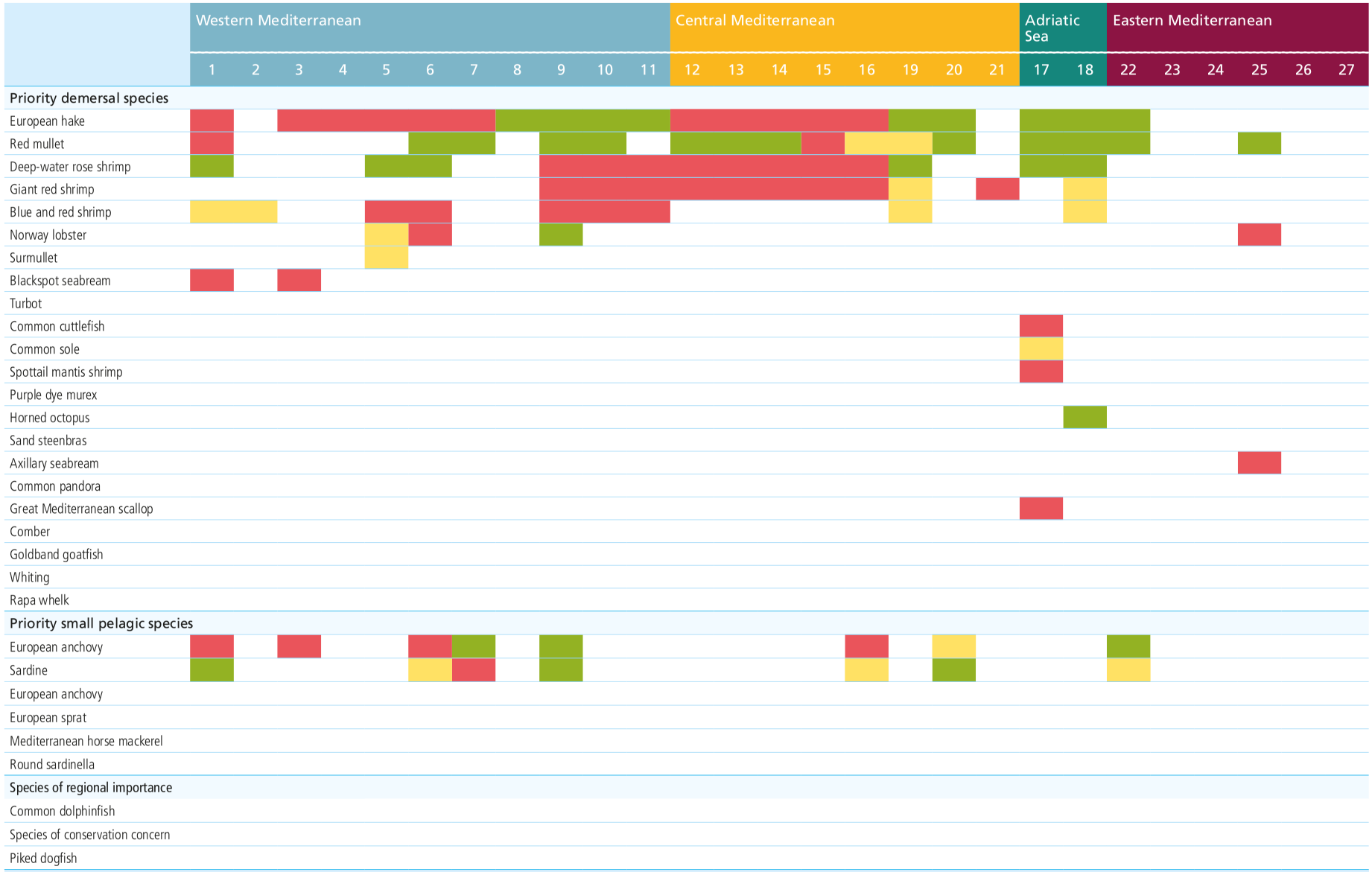
A comparative analysis with the reference year 2018, based on the 45 stocks for which biomass information was available in both years, reveals that the majority of stocks remain in the same biomass level group (30 stocks), while ten stocks have dropped to lower levels of biomass and five stocks have improved (Figure 76). Notably, the relative biomass of deep-water rose shrimp in GSAs 9–11, as well as of European hake in GSAs 12–16, appears to have declined in these two years, while European hake in GSAs 8–11, deep-water rose shrimp in GSA 5 and common sole in GSA 17 show improvements, among other stocks (Figure 76). Considering the comparable stocks between the current and previous edition (FAO, 2020a), the decrease in stocks with a high relative level of biomass was partially compensated for by an increase in stocks in the intermediate category.

Status and trends of priority species

Overall, all priority species with enough available information show an improved situation concerning fishing pressure in comparison with the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a). Blue and red shrimp presents an exception, with average fishing pressure having steadily increased since 2015, as well as deep-water rose shrimp, which shows an overall stable fishing pressure at nearly twice the level considered sustainable (Figure 77). In contrast, European anchovy shows a general decreasing trend in its exploitation ratio (Table 15, Figure 77), driven also by low exploitation ratios in the western Mediterranean. The exploitation ratios of sardine across the Mediterranean are characterized by high variation and the average exploitation ratio steadily increased until 2018, at which point the trend reversed, again owing to low exploitation ratios of stocks in the western Mediterranean (Figure 77). Among demersal species, previously observed decreasing trends in exploitation ratios for European hake, common sole and Black Sea turbot (Table 15, Figure 77) are confirmed, with common sole showing a reduction of 75 percent since 2011, and European hake and Black Sea turbot showing a reduction of 39 percent and 62 percent, respectively, since 2013. The fishing mortality of deep-water rose shrimp has increased by 3.5 percent since its lowest level in 2017 (F/F_{MSY} = 1.71) (Figure 77). Likewise, blue and red shrimp continues to show a rather significant increase in its exploitation ratio (F/F_{MSY} = 4) since a lowest recorded value in 2015 (F/F_{MSY} below 2), coupled with increasing catch. Finally, the catch of Norway lobster (*Nephrops norvegicus*) has decreased since 2017, as has the exploitation ratio (34 percent decrease) (Figure 77).

Focusing on particular key fisheries and analysing exploitation ratios and biomass levels together, the overall decreasing trend in the exploitation ratio (F/F_{MSY}) of European hake in the Tyrrhenian Sea (GSAs 8–11) and in the Strait of Sicily (GSAs 12–16), which already emerged in the previous edition (FAO, 2020a), is confirmed, while the expected corresponding increasing trend in biomass (B/B_{PA}) is less clear, especially for the latter. These trends may be suggestive of several factors, including either a delay in the response of stock biomass to decreasing fishing pressure or an insufficient reduction in fishing mortality to

TABLE 16. Relative biomass level by priority species and geographical subarea in the Mediterranean Sea



■ low relative biomass level; ■ intermediate relative biomass level; ■ high relative biomass level.

Notes:

Values are based on 80 validated stock assessments.

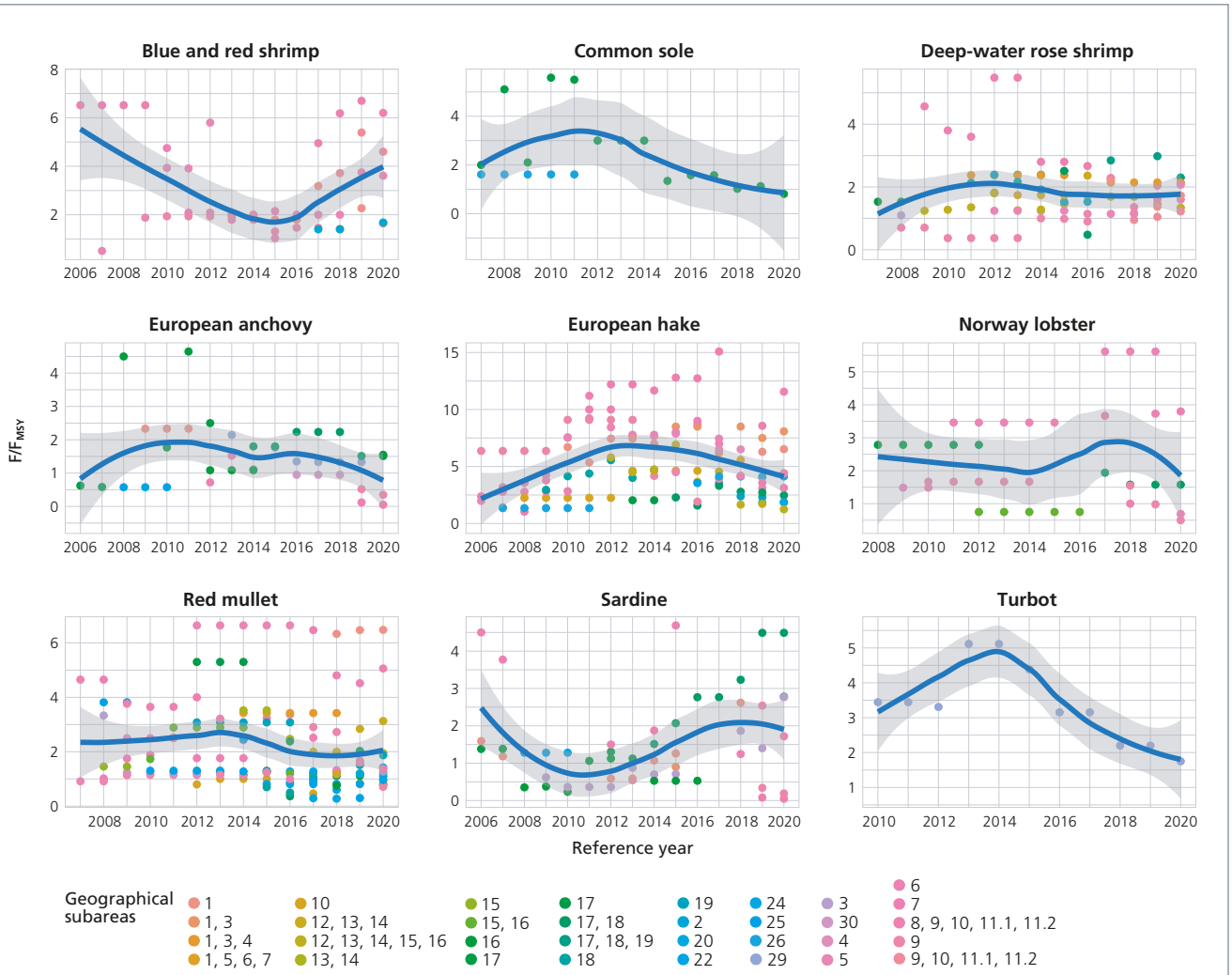
The estimation of relative biomass is based on either reference points or a percentile approach. Stocks subject to estimates of relative biomass levels using reference points are listed in the section "Overall status of stocks: biomass". Relative biomass levels are estimated using percentiles following the rationale: low = current biomass < 33rd percentile; intermediate = 66th percentile > current biomass > 33rd percentile; high = current biomass > 66th percentile.

promote an immediate and consistent increasing trend in stock size (Figure 78). On the other hand, for turbot in the Black Sea (GSA 29), the promising trend observed up to 2018 is confirmed, with a continued steady decrease in F/FMSY and a marked increase in B/BPA since 2014 (Figure 78).

Remarks on the quality of assessments and future developments

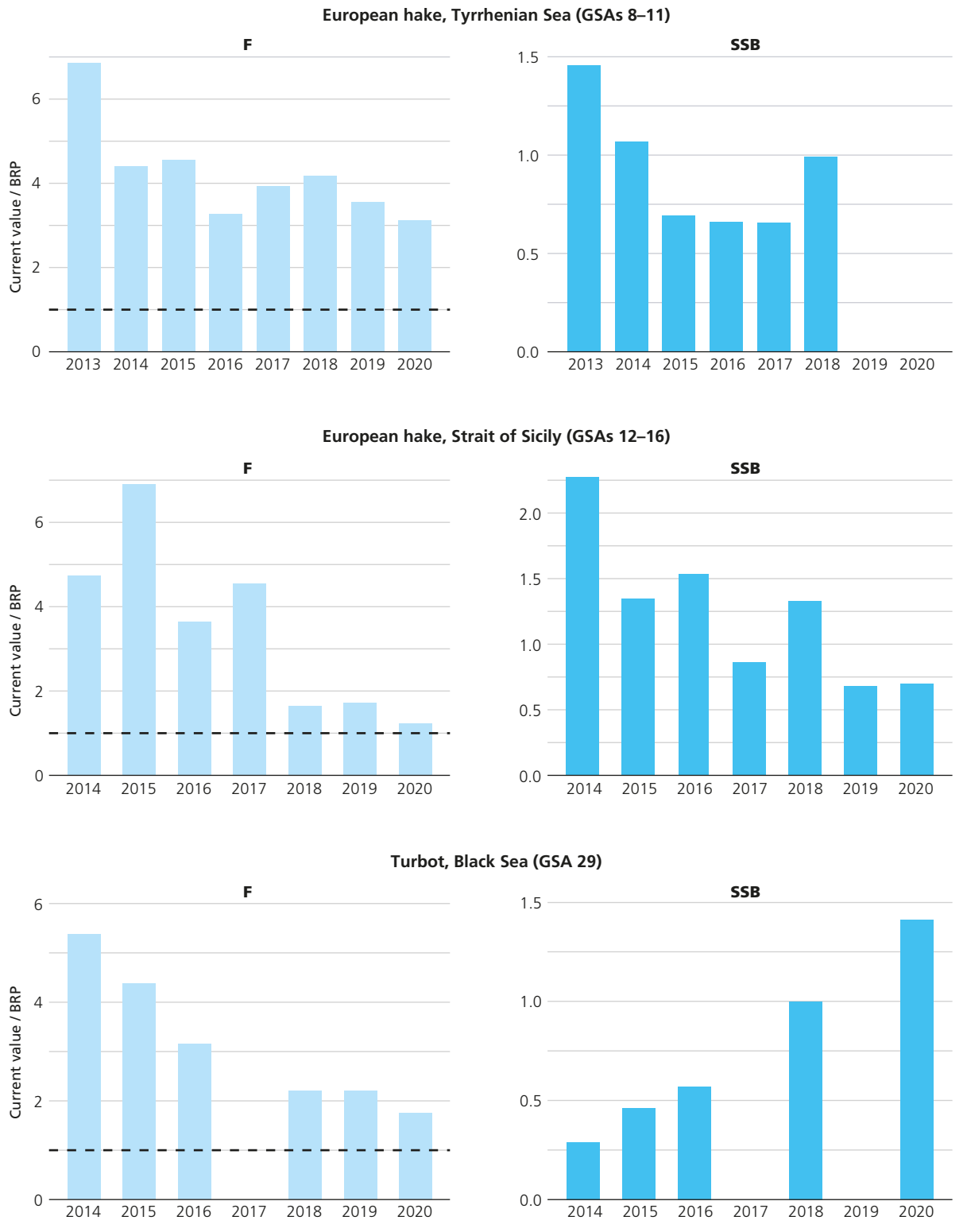
The coverage of assessments in the Mediterranean and the Black Sea has been increasing steadily over the past decade, reaching an historical maximum in this edition. The introduction of the benchmarking process in 2017 (Box 15) has improved the quality of assessments, owing to greater scrutiny of the input data and the adoption of more stringent standards. This development has resulted in a quarter of assessments failing to meet the full standards to provide quantitative advice in the reference year 2020 (Figure 70). In parallel, significant work has been, and is being, carried out towards assessing data-limited stocks, as well as towards data collection, and this progress has resulted in an increase in coverage in the eastern Mediterranean in particular. Nevertheless, efforts are still required to extend assessment coverage to all GSAs and to advance towards full quantitative coverage. Currently, most stock assessments are based on time series that are shorter than the available historical knowledge on fishing activities, and in some cases, even shorter than the complete time series of landings available. With a view to making future improvements in the quality of assessments, Box 13 illustrates the importance of

FIGURE 77. Trends in the exploitation ratios (F/FMSY) of select priority species until 2020



Note: Trends are shown using LOESS smoother. The shaded area represents the standard error, and the dashed line represents the exploitation ratio $F/F_{MSY} = 1$. Non-deprecated stocks have been considered in order to build the trend.

FIGURE 78. 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; GSA = geographical subarea; SSB = spawning stock biomass.
The dashed line represents $F/F_{MSY} = 1$; pending recalculation, reference points for turbot in 2020 represent an average of old and new reference points.
Biomass is expressed as SSB.

considering all auxiliary historical information available on stocks and fisheries through an analysis of the added value provided by timelines. This approach, together with the benchmarking process, may help to improve the estimates of reference points and increase the number of stocks with quantitative advice on biomass, while also ensuring full comparability between years in the future.

Finally, when taking a regional view of the analysis of trends in fishing mortality, the method currently employed rests on the use of a time series constructed per stock from fishing mortality estimates for the reference year of each year's assessment. With the aim of improving the picture of overexploitation over time at the regional level by ensuring that all available information is taken into account, Box 14 introduces a comparison between the analysis provided in this chapter and one derived from an alternative and complementary methodology.

CONCLUDING REMARKS

The percentage of stocks with validated assessments has continued to increase since the last edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a), particularly in the western Mediterranean, as has the geographical coverage of assessments. Nevertheless, efforts are still required to extend assessment coverage to all GSAs, while the decrease observed in the percentage of landings assessed highlights the need to ensure the regular assessment of key stocks with high landings, notably anchovy in the Black Sea.

Results show that since 2012, the average fishery exploitation ratio in the Mediterranean and the Black Sea has consistently decreased. However, in the Mediterranean Sea, the percentage of stocks with low biomass remains high, although lower than the cumulative percentage of stocks with intermediate and high biomass. Low biomass in an overall scenario of decreasing exploitation rates may be explained by either a delay in the response of stock biomass to declining fishing pressure or a reduction in fishing pressure insufficient to promote a recovery of biomass, or both. In the reference year 2020, 87 percent of the stocks assessed in the GFCM area of application were of medium- or long-lived demersal species, which may require several years to show an observable response in biomass.

A number of stocks of priority species (e.g. European hake in the Strait of Sicily, Black Sea turbot and common sole in the Adriatic Sea) have consistently shown improvements in their exploitation ratios over recent years. There is evidence that improvements in the exploitation ratio observed for Black Sea turbot continue to be matched by an increase in biomass. 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) is not matched so closely by corresponding increases in biomass; this disparity 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 in fishing mortality should not be taken as a guarantee of sustainability.

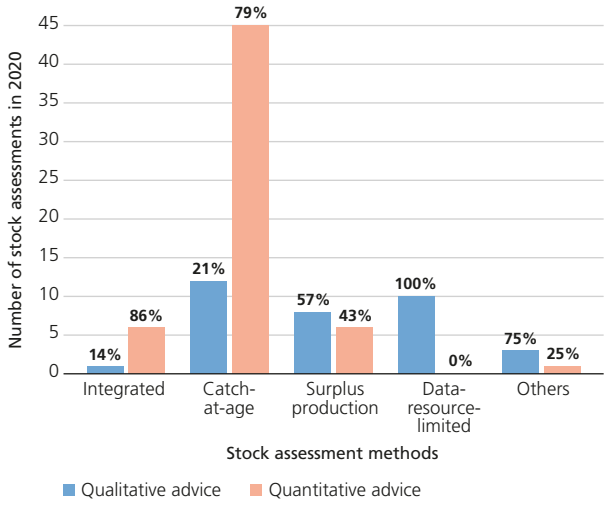
Conversely, blue and red shrimp shows an increasing trend in exploitation ratio, though this observation rests on an overall lack of assessments, as only seven stocks have been assessed to date, mostly in the western Mediterranean. Along with a lack of information on the origin of catch in the eastern-central Mediterranean, this shortcoming has hindered a fully informed implementation of the multiannual management plans and management measures in place in the Ionian Sea, Levant Sea and the Strait of Sicily, respectively (see Table 17).

The positive signs for fishing pressure provided by this overall analysis are most likely related to the adoption of a significant number of national and regional management measures in the recent past, underpinned by an increase in the quality and coverage of scientific advice, particularly on priority species and key fisheries. Measures adopted include management plans that incorporate effort control measures and/or the introduction of quota-based management for some species, as well as the establishment of fisheries restricted areas and spatio-temporal limits to protect essential habitats and life stages (see Chapter 7). Nevertheless, the slow recovery in biomass of certain key stocks and the need to honour the objectives of the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (GFCM 2030 Strategy) (FAO, 2021) (see Box 1) point to the importance of continuing to implement an effective and generalized management framework, including through strengthening existing management plans and defining new ones, as well as ensuring the effective implementation of those in place.

Box 13. The role of timelines in informing stock assessments

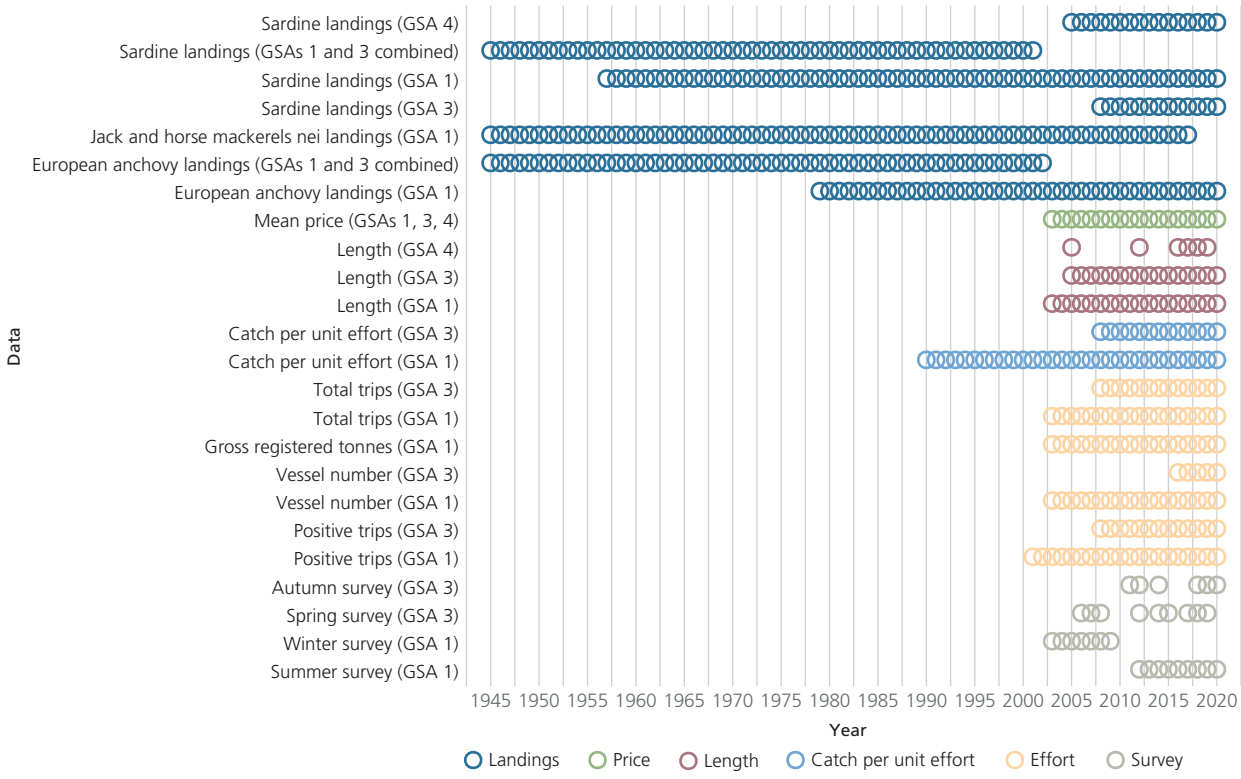
Stock assessment relies on the best available information on the biology of a given species and the fishery exploiting it in order to inform advice on stock status and, in turn, management. In 2020, advice was provided for 80 stocks in the GFCM area of application after undertaking 92 stock assessments. Catch-at-age models (XSA, a4a, SAM) were most commonly used (n = 57) to provide quantitative advice (79 percent) (Figure "Contribution of stock assessment methods to the provision of advice in the GFCM area of application in 2020"). These models rely on time series of catch-at-age data from the fishery and biomass indices of fishery-independent surveys, which are typically constructed for the period from 2000 onwards, when length data from these data sources became commonly available (example in Figure "Time series of data considered to perform the assessment of small pelagic stocks in the Alboran Sea").

Contribution of stock assessment methods to the provision of advice in the GFCM area of application in 2020



Note: Percentages indicate relative proportions of stock assessments providing quantitative and qualitative advice for each stock assessment method in 2020.

Time series of data considered to perform the assessment of small pelagic stocks in the Alboran Sea



(Continued)

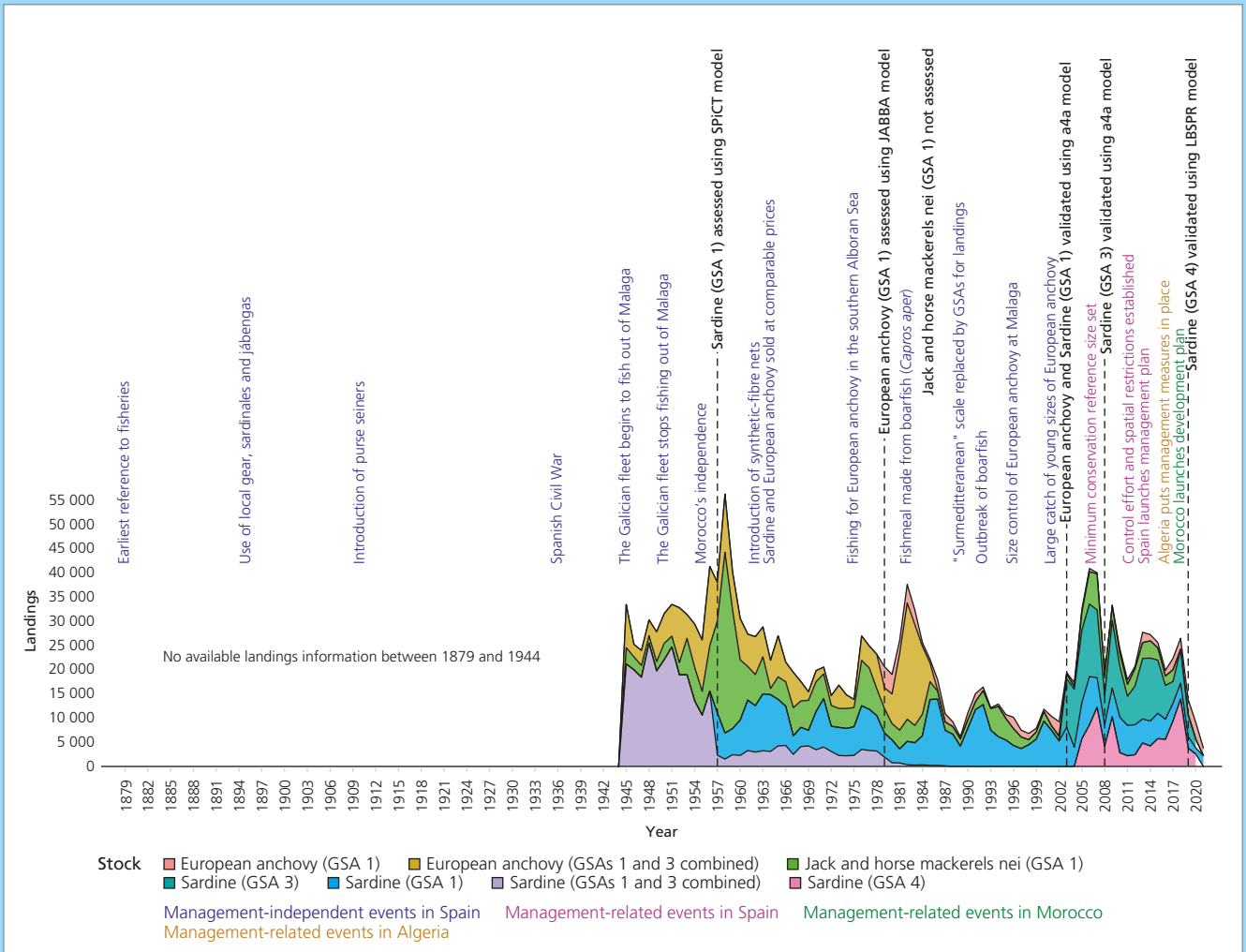
Box 13 (continued)

Including longer time series of landings in stock assessments provides a historical perspective on the evolution of fishing pressure, as they contain important information about stock size and maximum sustainable yield. However, such time series present comparability challenges related to so-called events, i.e. different periods defined by either management-related actions (e.g. changes in gear characteristics) or management-independent factors (e.g. variations in the environmental conditions or socioeconomic circumstances).

This box aims to present timelines and relate such events to the time series of landings by highlighting key considerations for stock assessment. The small pelagic fishery in the Alboran Sea features as a case study.

For sardine in geographical subarea (GSA) 1, the maximum annual landings in the time series used in the catch-at-age stock assessment model is 9 971 tonnes, which is only 72 percent of the maximum landings in the extended historical catch time series (1957–2020) used in a preliminary surplus production model and only 39 percent of the maximum reported landings in 1948 (Figure "Timeline of the small pelagic fishery in the Alboran Sea").

Timeline of the small pelagic fishery in the Alboran Sea



Notes:
Landings are reported for sardine, European anchovy and jack and horse mackerels nei in GSAs 1, 3, 4 and 1 and 3 combined.
Validated and trialled stock assessments are shown in correspondence with the beginning of the time series used to run them (vertical dashed lines).

(Continued)

Box 13 (continued)

More significant variations are found for European anchovy in GSA 1, as the maximum landings of the time series used for the validated a4a assessment is just 14 percent of the maximum reported landings in 1982 (see Figure "Timeline of the small pelagic fishery in the Alboran Sea"). Analysing longer time series involves additional complexity because the data for landings come cumulatively from the southern and northern Alboran Sea combined (see Figure "Time series of data considered to perform the assessment of small pelagic stocks in the Alboran Sea") and are therefore linked to different geographical areas before and after 2000.

The fishery in the northern Alboran Sea has been recognized since 1879 and was first developed using traditional types of fishing gear, before purse seiners were introduced in 1910. The reporting of landings only began in 1945, corresponding to the period when the Galician fleet was based out of Malaga. Following Morocco's independence from France in 1956, the Spanish fleet reduced its fishing activity in the southern Alboran Sea. During this period, the largest landings of mackerel-like species (*Trachurus* spp.) occurred, at 37 353 tonnes (see Figure "Timeline of the small pelagic fishery in the Alboran Sea"). In 1996, controls on small-sized anchovy were enforced, resulting in a lower share of juveniles in landings after that date.

Controls on fishing effort and gear characteristics, as well as temporal and spatial closures, were implemented after 2000, among other measures (see Figure "Timeline of the small pelagic fishery in the Alboran Sea"). The enforcement level of such measures has yet to be fully understood, as is their contribution to the control or reduction of fishing mortality. For instance, the drastic decrease in sardine landings in GSA 3 since 2018 is more likely due to the displacement of the purse seiner fleet to Atlantic waters in response to decreasing levels of biomass in the Mediterranean rather than due to a planned reduction in fishing effort.

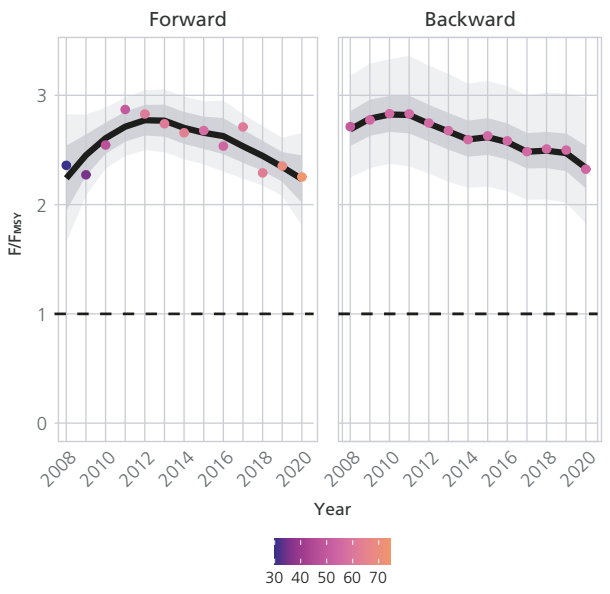
The timeline of the fishery is key to understanding the scale of declines or increases in population and catch over time, reconstructing the time series of landings, conducting sensitivity analyses within stock assessments and identifying what management measures should be tested as part of a management strategy evaluation. The Alboran Sea small pelagic fishery provides a particularly useful case study to evaluate the implications of landings – in the context of a longer historical perspective – on stock assessments, as well as the advice emerging from them. Where suitable data are available over longer periods of time, such an approach should ideally be applied to other fisheries.

Box 14. Characterizing exploitation ratios from the stocks and management perspectives

The time series of exploitation ratios (F/F_{MSY}) presented in all editions of *The State of Mediterranean and Black Sea Fisheries* thus far[1, 2, 3] track the history of stock status advice for quantitatively assessed stocks in the GFCM area of application. In other words, this approach (forward approach) tracks the scientific advice from the most recently validated assessments (over the period 2008–2020) to build a combined trend, while also considering non-deprecated stock assessments (i.e. assessments from previous years that are still considered to be valid for a period of time; see introductory sections of Chapter 5).

Capitalizing on increases in coverage and in the quality of stock assessments, an alternative approach could be to analyse stock trajectories as estimated from the most recent assessment estimates (backward approach). In 2020, the Scientific Advisory Committee on Fisheries (SAC) suggested that the two different approaches be assessed and compared with a view towards a potential revision of the indicators on the status of stocks used in *The State of Mediterranean and Black Sea Fisheries*.

Trend in F/F_{MSY} for all stocks using the forward and backward approaches



Notes:
Associated 95 percent and 75 percent confidence intervals are shown in dark and light shadow, respectively.
The forward trend is modelled by Loess smoother (shadow area representing the standard error), and the backward trend uses the Bayesian state–space approach for an ad hoc normal approximation.
STECF (Scientific, Technical and Economic Committee for Fisheries). 2022. *Suitability study of the Bayesian State-Space model 'JARA' for stock status indicator estimation*. Luxembourg, Publications Office of the European Union.
Winker, H., Pacoureau, N. & Sherley, R.B. 2020. JARA: Just Another Red-List Assessment. *BioRxiv*, 672899.

The backward approach is implemented using a Bayesian state–space model[4, 5] to provide a consistent analysis of how the average stock status across the region is developing with respect to the sustainable fishery goals of the GFCM. In addition, this approach allows for a comparison between the outputs of Mediterranean and Black Sea stock assessments and those from other regions worldwide.[6]

Here, a first analysis based on the two approaches is outlined by considering the trend in F/F_{MSY} for all stocks assessed for the reference year 2020 (backward), and the last year in the estimated time series for all available assessments by stock from 2008 to 2020 (forward). In both cases, overexploitation is clearly observed, maintaining a very similar trend since 2012. However, there are some differences that deserve attention. The overlap in the trend for most recent years is due to a high coincidence between the number of assessments, as well as greater overlaps between estimates. Conversely, the earlier part of the forward trend is constrained by the low number of assessments used to build the trend, while the backward approach benefits from numerous assessments maintaining longer time series, at least since 2008 or beyond.

The forward trend is modelled by Loess smoother (shadow area representing the standard error), and the backward trend uses the Bayesian state–space approach[4, 5] for an ad hoc normal approximation. In summary, both approaches provide a coherent view of the trends in overall fishing pressure, while the backwards approach may provide a more realistic view of the whole trend in F/F_{MSY} since the beginning of the time series. A comprehensive analysis of the use of both approaches at the regional scale, as well as by priority stock, will be presented to relevant SAC expert groups to facilitate a decision on the process for the estimation of indicators for future issues of *The State of Mediterranean and Black Sea Fisheries*.

[1] **FAO.** 2016. *The State of Mediterranean and Black Sea Fisheries 2016*. General Fisheries Commission for the Mediterranean. Rome. https://www.fao.org/3/i5496e/i5496e.pdf
[2] **FAO.** 2018. *The State of Mediterranean and Black Sea Fisheries 2018*. General Fisheries Commission for the Mediterranean. Rome. https://www.fao.org/3/ca2702en/CA2702EN.pdf
[3] **FAO.** 2020. *The State of Mediterranean and Black Sea Fisheries 2020*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://doi.org/10.4060/cb2429en
[4] **STECF (Scientific, Technical and Economic Committee for Fisheries).** 2022. *Suitability study of the Bayesian State-Space model 'JARA' for stock status indicator estimation*. Luxembourg, Publications Office of the European Union.
[5] **Winker, H., Pacoureau, N. & Sherley, R.B.** 2020. JARA: Just Another Red-List Assessment. *BioRxiv*, 672899.
[6] **Hilborn, R., Hively, D.J., Loke, N.B., de Moor, C.L., Kurota, H., Kathena, J.N., Mace, P.M., *et al.*** 2021. Global status of groundfish stocks. *Fish and Fisheries*, 22(5): 911–928.

Box 15. Benchmarking process and changes in providing advice on the status of fishery resources

From 2012 to 2016, the number of stock assessments annually performed increased by 7 percent, while between 2019 and 2020, this number jumped up by 10 percent. The increase in the coverage of scientific advice was prompted by efforts made through the GFCM mid-term strategy (2017–2020) towards the sustainability of fisheries in the Mediterranean and Black Sea,[1] and later by the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (GFCM 2030 Strategy),[2] both requiring that the increase in coverage also be accompanied by a quality control process and an optimization of the time dedicated to each stock assessment. These issues were addressed at the forty-second session of the GFCM which endorsed a process for benchmarking stock assessments.

A benchmark assessment is defined as a review and comprehensive analysis of all available information based on the best fisheries science to date (i.e. the most up-to-date models and reviewed assumptions) in order to provide advice on the status of a given stock. In particular, the benchmark process includes: revising life-history parameters; characterizing the harvested stock; updating or confirming stock identity; estimating one or more fishery-independent biomass index(es), and making available coherent and comparable sources of fishery data (e.g. landings and length structure of stock).

The above-mentioned process implies addressing previously identified shortcomings in the provision of advice for each stock, revising and agreeing upon data, assumptions and chosen assessment methods, and indicating the comparative advantages of different alternative options. Usually, the benchmark process requires at least two different types of sessions – data preparation and stock assessment – and, if successful, results in the estimation of reference points for the sustainability of each particular stock and the formulation of advice on the status of the stock in relation to those reference points.

Benchmark sessions are attended by fishery and stock assessment methodology experts, both from relevant areas or GFCM subregions and from outside the GFCM area of application. Additionally, external reviewers provide expert views and report on the technical discussions, evaluate the quality of advice and make suggestions for improvement when relevant.

Following the benchmark session, all historical data, assumptions and models are expected to be fixed for three to four years. Assessments carried out over this period will provide updates incorporating data from the most recent year(s), thereby relieving the relevant working groups from needing to carry out further analysis. As part of the updating process, the agreed assessment conditions should be confirmed. An interbenchmark session could occur if, for instance, the updated data prevent the provision of advice under the conditions already agreed upon at the benchmark session.

The schedule of benchmark assessments is proposed each year by the Scientific Advisory Committee on Fisheries and the Working Group on the Black Sea and endorsed by the GFCM at its annual session. 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. This approach thus ensures that benchmarks are based on the most recent data possible.

The increase in quantity and types of stock assessments and the introduction of benchmarks have prompted a discussion on modernizing the existing framework for the provision of advice endorsed in 2014. As a result, the forty-third session of the GFCM agreed to launch a process for revising and updating such a framework, which is expected to be finalized in the coming years.

[1] **FAO.** 2017. *Mid-term strategy (2017-2020) towards the sustainability of Mediterranean and Black Sea fisheries*. Rome, FAO. https://www.fao.org/3/i7340en/i7340en.pdf

[2] **FAO.** 2021. *GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://doi.org/10.4060/cb7562en

(Continued)

Most recent GFCM benchmark assessments

Benchmark assessment	Dates	Geographical subareas assessed	Validation status	Reference year	Data year compared to advice year
Red mullet in the central Mediterranean	19–21 November 2018	12, 13, 14	Twenty-first SAC session (2019)	2017	n-2
		15			
		16			
		19			
European sprat in the Black Sea	27–28 November 2018	29	Advice provided, benchmark not finalized	2020	n-2
European hake in the Adriatic Sea	17–18 January 2019	17, 18	Twenty-first SAC session (2019)	2017	n-2
Blackspot seabream in the Strait of Gibraltar	1–4 April 2019; 9–14 December 2019; April and May 2020	1, 3	Twenty-second SAC session (2021)	2019	n-2
Turbot in the Black Sea	8–12 July 2019; 16–17 September 2019	29	Ninth WGBS session (2021) and updated in 2022 with new reference points	2021	n-1
European acnhovy in the Adriatic Sea	13–16 May 2019; July–November 2020	17, 18	Twenty-second SAC session (2021)	2019	n-1
Sardine in the Adriatic Sea	13–16 May 2019; July–November 2020; 19 May 2022	17, 18	Advice provided, benchmark not finalized	2021	n-1
European hake in the Mediterranean Sea	2–7 December 2019	1, 5, 6, 7	Advice provided, benchmark not finalized	2020	n-2
		1, 2, 3			
		4			
		8, 9, 10, 11	Twenty-second SAC session (2021)		
		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	Advice provided, benchmark not finalized	2020	n-2
		3	Twenty-second SAC session (2021)		n-2
		4	Advice provided, benchmark not finalized		n-2
European anchovy in the western Mediterranean Sea	18–23 January 2021	7	Twenty-second SAC session (2021)	2019	n-2
Sardine in the western Mediterranean Sea		6			
Sardine in the western Mediterranean Sea		7			
Common sole in the Adriatic Sea	12–16 April 2021	17	Twenty-second SAC session (2021)	2019	n-2
Round sardinella in the eastern Mediterranean Sea	17–21 May 2021	24	Twenty-second SAC session (2021)	2019	n-1
Round sardinella in the eastern Mediterranean Sea	17–21 May 2021	26, 27 (Palestine)	Twenty-second SAC session (2021)	2019	n-2
European anchovy in the central Mediterranean Sea	14–18 March 2022	16	Twenty-third SAC session (2022)	2020	n-2
Sardine in the central Mediterranean Sea	14–18 March 2022	16	Twenty-third SAC session (2022)	2020	n-2
Red mullet in the Adriatic Sea	14–18 March 2022	17, 18	Advice provided, benchmark not finalized	2020	n-2

©GFCM/Sabhi Dorai

PART 2
Management of Mediterranean and Black Sea fisheries

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

Small-scale fisheries (SSF) represent the largest fleet segment group in the Mediterranean and Black Sea region, accounting for 82 percent of the fleet and 59 percent of employment on board vessels but only 27 percent of revenue and 15 percent of catch, as highlighted in Chapters 1, 2 and 3. Furthermore, SSF are intimately linked with the livelihoods, traditions and cultural heritage of coastal communities around the Mediterranean and the Black Sea. The need to preserve this sector by enhancing its resilience and supporting its long-term sustainability is the underlying principle behind the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF) (FAO, 2021) (Box 16). The RPOA-SSF has spurred efforts at the regional level to engage stakeholders and to improve knowledge of the sector – for example, through regional programmes like the Small-Scale Fishers' Forum (SSF Forum) (FAO, 2022b) (Box 18) and ad hoc studies and data collection initiatives – that seek to complement efforts underway at the national and local levels.

Box 16. Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea

The Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF)[1] was adopted in 2018 as a Ministerial Declaration. Signed by 19 countries and the European Union (with Egypt joining the signatories in 2021), it recognizes the essential role of small-scale fisheries (SSF) in the region, as well as the challenges they face, and sets forth a ten-year roadmap (through 2028) of concrete actions to be implemented. These actions are grouped into nine main areas: (A) scientific research; (B) SSF data; (C) SSF management measures; (D) SSF value chain; (E) participation of SSF in decision-making processes; (F) capacity-building; (G) decent work; (H) role of women; and (I) climate and environment.

Sections A, B, C and I of the RPOA-SSF recognize that enhancing knowledge of SSF, through robust scientific research and regular and complete data collection, is essential for supporting evidence-based and sustainable management of the sector, as well as for responding to threats like climate change. Sections D, G and H highlight the role of SSF in providing employment for men and women in the region, including up and down the value chain, and underline the need to strengthen the SSF value chain in an integrated way that not only provides livelihoods, but also ensures respect for the principles of decent work and elevates the role played by women in the sector. Finally, sections E and F prescribe capacity-building actions to empower SSF stakeholders – particularly young people and women – through participatory data collection, co-management bodies and dedicated training courses. A transversal principle stressed throughout the RPOA-SSF is a participatory approach built on a foundation of strong partnerships between fishers, scientists and decision-makers. The RPOA-SSF recognizes that this stakeholder engagement is essential for successful outcomes that are well adapted to the realities of the sector.

A monitoring framework for the implementation of the RPOA-SSF was developed, in coordination with the Friends of Small-Scale Fisheries (Friends of SSF) platform,[2] and was adopted at the forty-third session of the GFCM in 2019, following a stakeholder consultation process. It identified indicators for measuring advances in the plan's implementation and defined short-term (2022) and mid-term (2024) targets to benchmark progress towards the ultimate objectives set for 2028. With a view to collecting baseline information on the state of the SSF sector at the time of adoption of the RPOA-SSF, a questionnaire was prepared in line with the monitoring framework and was circulated to GFCM contracting parties and cooperating non-contracting parties in 2020. The analysis of the responses to this questionnaire was published in *The State of Mediterranean and Black Sea Fisheries 2020*.[3]

The baseline analysis carried out in 2020 highlighted the need to strengthen the fisher–science–policy interface, enhance the body of knowledge on SSF value chains, advocate for decent work (particularly in light of the COVID-19 crisis) and identify and reinforce links with the main SSF actors in the region. Specific priority actions identified by the baseline analysis included:

- Fill gaps in data collection, ensuring that all CPCs have the capacity to monitor SSF through up-to-date fleet registers and accurate catch, effort and socioeconomic data collection.
- Identify and assess key coastal species of particular importance to SSF.
- Strengthen the network of relevant researchers and stakeholder organizations.
- Provide fishers with practical tools to facilitate their contributing to management processes.
- Provide guidance on ensuring gender-disaggregated data collection along the value chain.
- Encourage the ratification of the International Labour Organization Work in Fishing Convention, 2007 (No. 188).[4]
- Promote specific interventions to improve social protection access and coverage.
- Provide increased opportunities for SSF organizations to participate in GFCM events, like the Small-Scale Fishers' Forum (SSF Forum),[5] and to contribute input to the work being carried out.
- Increase efforts to engage a wider number of stakeholders, particularly women and young people.

[1] **FAO.** 2021. *The Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://www.fao.org/3/cb7838en/cb7838en.pdf

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

[3] **FAO.** 2020. *The State of Mediterranean and Black Sea Fisheries 2020*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://doi.org/10.4060/cb2429en

[4] **ILO (International Labour Organization).** 2007. C188 - Work in *Fishing Convention, 2007 (No. 188). In: International Labour Organization - ILO*. Geneva. Cited 7 December 2022. www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:12100:0::NO::P12100_ILO_CODE:C188

[5] **FAO.** 2022. SSF Forum. In: *General Fisheries Commission for the Mediterranean*. Rome. Cited 21 November 2022. www.fao.org/gfcm/activities/fisheries/small-scale-fisheries/ssfforum/en

To take stock of advances made and guide better action to support the sector, this chapter first analyses the current state of the implementation of the RPOA-SSF and follows with a reflection on the progress made and challenges faced, with a view to identifying the next steps.

PROGRESS ON IMPLEMENTING THE REGIONAL PLAN OF ACTION FOR SMALL-SCALE FISHERIES IN THE MEDITERRANEAN AND THE BLACK SEA

Building on the advice of the Working Group on Small-Scale Fisheries (WGSSF) (GFCM, 2022) and the subregional committees, the Scientific Advisory Committee on Fisheries recognized, at its twenty-third session in June 2022, the continued need to monitor and enhance the implementation of the RPOA-SSF. Following the model of the monitoring framework questionnaire developed in 2020 to assess the baseline status of RPOA-SSF implementation (Box 16), an updated questionnaire was prepared and circulated in 2022 in order to collect comparable information and effectively evaluate advances in implementation made since 2020. Additional questions were incorporated into the questionnaire, linked to priorities highlighted on the occasion of a high level event on advancing the RPOA-SSF in the context of the GFCM 2030 Strategy in June 2021 (Box 17), as well as the inputs of experts during the WGSSF technical meeting in March 2022.

The analysis presented in this chapter refers to the status of RPOA-SSF implementation in 2022, based on the responses of GFCM contracting parties and cooperating non-contracting parties (CPCs) to the updated monitoring framework questionnaire. In total, 16 CPCs[13] replied to the questionnaire, although some did not reply to every question due to a lack

[13] Albania, Bulgaria, Cyprus, Egypt, France, Georgia, Greece, Lebanon, Libya, Malta, Montenegro, Morocco, Romania, Slovenia, Syrian Arab Republic and Türkiye.

Box 17. High-level event on advancing the RPOA-SSF in the context of the GFCM 2030 Strategy

A high-level event on advancing the RPOA-SSF in the context of the GFCM 2030 Strategy took place online on 30 June 2021. This event was held within the context of discussions on the adoption of the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (GFCM 2030 Strategy) (see Box 1) and the development of COVID-19 economic recovery plans by countries in the region. It sought to bring together high-level representatives and small-scale fishers in order to reaffirm a future vision for the small-scale fisheries (SSF) sector and to underline the central role of the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF) (see Box 16) in accelerating the transition to achieving that vision. The event reviewed early successes and lessons learned in implementing the RPOA-SSF and discussed topics requiring increased focus in light of changing priorities prompted by the COVID-19 pandemic, while also assessing whether additional political pressure, financial support or field work were needed.

Key conclusions of the high-level event centred on the following requirements:

- Promote new financial initiatives to address challenges, such as promoting the role of women and facilitating the access of younger generations to the sector.
- Raise awareness of SSF concerns to ensure that they are considered in national dialogues on the development of COVID-19 economic recovery plans and investments.
- Enhance the development of participatory mechanisms and co-management plans at the local level.
- Facilitate access to social protection programmes that enhance the resilience of coastal communities in response to current (e.g. COVID-19) and future (e.g. climate change) crises.
- Support scientific monitoring and advice on the sustainability of SSF through regular and complete collection and reporting of data on catch and landings.
- Support the creation of multiannual management plans.
- Develop viable economic alternatives and market opportunities to improve fishers' livelihoods, including through strengthening shorter value chains and direct sales.

FIGURE 79. Percentage of GFCM contracting parties and cooperating non-contracting parties requesting small-scale vessels to report landings at designated landing ports

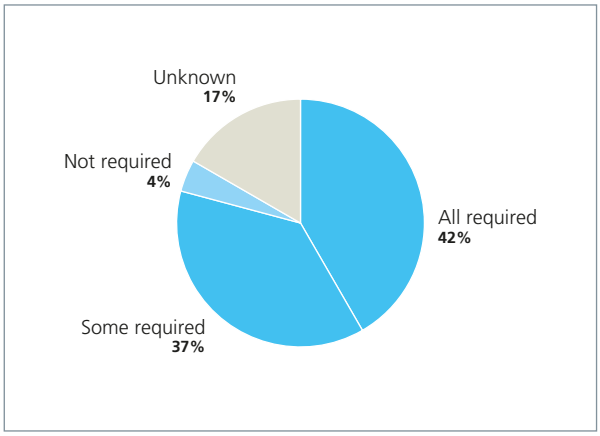
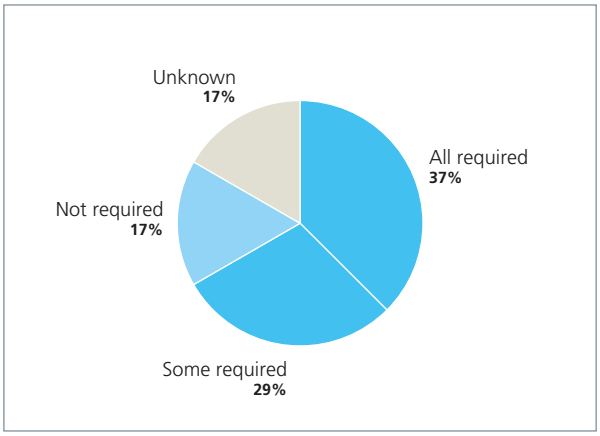


FIGURE 80. Percentage of GFCM contracting parties and cooperating non-contracting parties requesting small-scale vessels to report landings through self-reporting tools



of available information. Although fewer responses were received in 2022 than in 2020, attempts were made to complement the analysis with information from alternative sources (e.g. the GFCM SSF mapping tool, data submissions to the GFCM Data Collection Reference Framework, expert input or previous questionnaire responses) where information had not been provided. Percentages of CPCs indicated throughout this chapter therefore reflect percentages of all CPCs, including those who did not respond to the questionnaire.[14] As a follow-up, a complementary questionnaire was also circulated to CPCs in order to gain insight into the challenges they faced when implementing the RPOA-SSF, with a view to identifying specific needs for future support. An analysis of these barriers to implementation was carried out based on the responses to this second questionnaire (albeit received from a limited number of CPCs)[15] and is presented at the end of this chapter.

Enhancing the science–policy interface for small-scale fisheries

Building on the baseline analysis carried out in 2020, the 2022 questionnaire sought to understand how scientific research and SSF data have changed since the adoption of the RPOA-SSF, including on specific topics like climate change, and how these shifts may have influenced the management of SSF.

As GFCM experts have concluded that the foundations for robust SSF data collection are a complete fleet register covering all SSF vessels and an obligation for SSF to report landings (GFCM, 2019), the questionnaire circulated in 2022 collected information on these two topics. The results showed that, in 2022, 18 CPCs (75 percent of all CPCs) boasted SSF fleet registers, with four CPCs not responding and only Georgia and Libya indicating that they did not have registers. This situation reflects no improvement from the baseline, with the only revision coming from Libya, who confirmed that they no longer have a register. In general, the information contained within the fleet registers of most CPCs included the name of the vessel, the vessel registration or matriculation number, the port of registration, the year of construction, the length overall, the gross tonnage, the gear used and the horsepower. A limited number of CPCs also included the port of landing, number of days at sea, information on the owner (e.g. name and address), year of construction and materials, fishing licence and engine reference.

An obligation to report landings from SSF can be fulfilled through adequate monitoring at designated landing points or through self-reporting tools such as logbooks. In 2022, 19 CPCs (80 percent of all CPCs) required that all or some small-scale vessels report landings at designated landing ports; Türkiye was the only respondent CPC that did not have this requirement, while four CPCs did not respond at all (Figure 79). This situation

[14] Excluding Monaco, Jordan and the Republic of Moldova which do not report SSF vessels in their fleet.

[15] Bulgaria, Cyprus, Georgia, Greece, Lebanon, Libya, Montenegro, Morocco, Romania, Slovenia and Türkiye.

marks an improvement from the baseline at the regional level, as previously, three CPCs had not required any of the SSF fleet to report landings at designated landing ports. Similarly, 16 CPCs (67 percent of all CPCs) require that all or some small-scale vessels report landings through self-reporting tools such as logbooks, indicating that an additional CPC has added this requirement since the baseline analysis was carried out (Figure 80). It is worth noting that although Türkiye does not require SSF to report landings at designated landing ports, it does require all SSF to use self-reporting tools, thereby ensuring monitoring of the sector.

Employment data are also essential towards understanding the socioeconomic impact of SSF in the region. The questionnaire results show that data collection continues to be focused on vessel based SSF activity in the region. Twenty CPCs report collecting vessel-based employment data for SSF (83 percent of all CPCs), 14 of which report that these data are gender-disaggregated (58 percent of all CPCs) (Figure 81). Compared to the baseline, the number of CPCs collecting vessel-based SSF employment data has remained unchanged, though the number of CPCs collecting gender-disaggregated data has increased by two. However, data collection on non-vessel-based SSF activity (such as shore-based fishers and gleaners) remains limited and comparable to 2020 levels, with only five CPCs reporting that they collect this information. Similarly, only ten CPCs collect employment data for the SSF post-harvest sector. Therefore, improving data collection for these latter groups would help to better capture the contributions of women to SSF, as the majority of women in the sector work in these two areas.

As underlined in the analysis of the baseline status of the SSF sector in 2020, there is an imperative need to further engage with fishers in scientific monitoring and research. The results of the 2022 questionnaire have shown that CPCs continue to facilitate science–fisher collaboration on SSF research (in 8 of 15 responding CPCs). However, the high degree of non-responses to this question (38 percent of all CPCs) highlights the need for continued guidance on what might constitute participatory data collection to ensure that this step is completed in a concerted way.

Finally, in order to guarantee the appropriate and sustainable management of the main species upon which SSF rely, in 2022 the WGSSF underlined the need to assess the status of stocks of these species, while also considering the impacts of SSF on GFCM priority species. To this end, a new question was added to the questionnaire in 2022 to assess whether countries had data collection systems in place to facilitate the assessment of stocks of SSF main species. Eight CPCs (33 percent of all CPCs) indicated having such systems in place, while five CPCs (21 percent) did not and 11 CPCs (46 percent) did not respond, indicating that further work was needed to better understand the capacities of CPCs to integrate SSF into stock assessment efforts (Figure 82).

With respect to management, in 2022 ten CPCs reported having management measures in place specific to SSF, resulting in no change from the baseline. Some of these CPCs have, however, adopted new measures since 2020. For example, Greece adopted new measures for the protection

FIGURE 81. Percentage of GFCM contracting parties and cooperating non-contracting parties collecting employment data on small-scale fishing activities

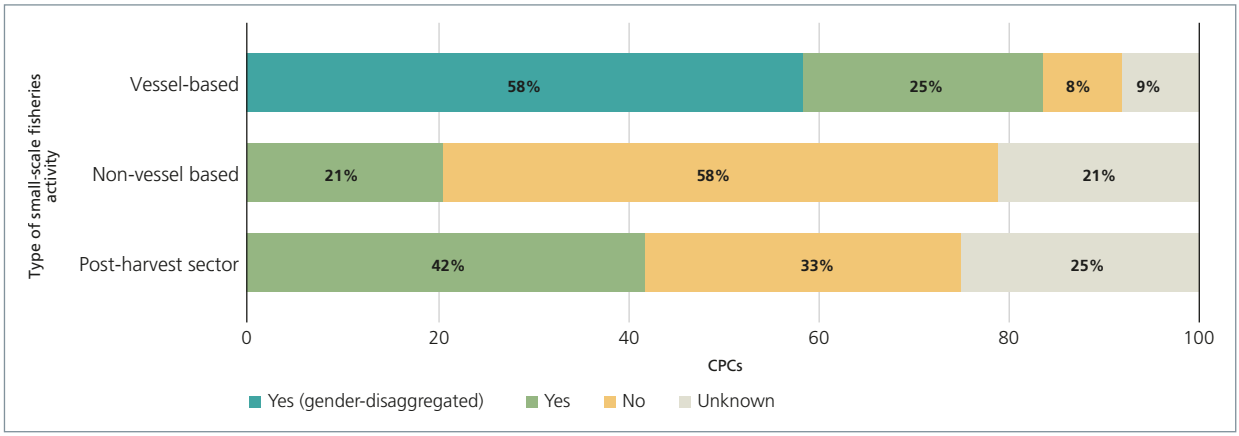


FIGURE 82. Percentage of GFCM contracting parties and cooperating non-contracting parties with data collection systems in place to assess stocks of small-scale fisheries main species

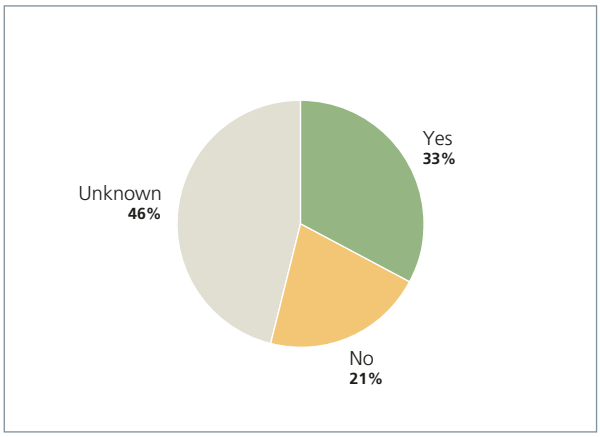
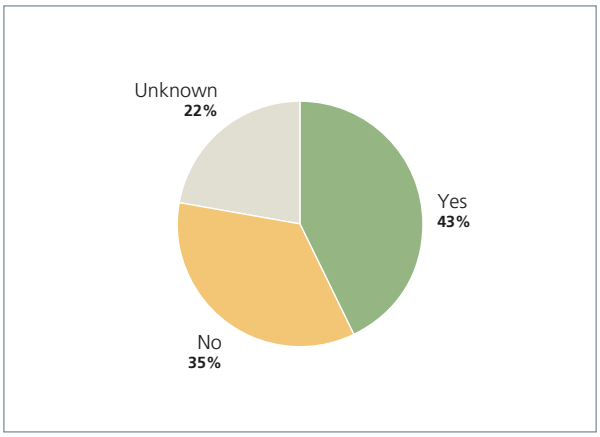


FIGURE 83. Percentage of GFCM contracting parties and cooperating non-contracting parties with co-management (or similar participatory management) systems in place



of certain species targeted by SSF, whereas Türkiye implemented measures to supply direct support to SSF vessels, provided that they have valid licences and are registered in the fisheries information system. Furthermore, while management measures are essential to the sustainability of the SSF sector, ensuring compliance with these measures is equally important. Overall, eight CPCs reported having established participatory monitoring, control and surveillance (MCS) programmes or similar participatory management mechanisms, representing a net increase of two CPCs since 2020.

Another new question was added to the questionnaire in 2022 to assess whether CPCs had implemented co-management systems. Ten CPCs (43 percent of all CPCs) have instituted co-management arrangements or similar participatory management systems since 2020 (Figure 83). Among some of the replies provided by CPCs to the questionnaire, Albania indicated that it had undertaken work to organize SSF into small fisheries management organizations, and Greece noted the Amorgorama project, through which local SSF organizations on the island of Armorgos have cooperated with scientists to create a local marine protected area. Similarly, Türkiye reported that, under the Ministry of Agriculture and Forestry of the General Directorate of Fisheries and Aquaculture, a fisheries and aquaculture advisory board was established with the participation of universities, cooperatives and other relevant institutions.

In line with the increase in the number of countries with an obligation to report landings at dedicated landing sites (Figure 79), the number of designated landing sites has also increased in 2022 to 2 480 (from 2 394 in 2020), further reinforcing access rights for SSF and appropriate infrastructure to support SSF activities. Although the minimum services provided at these landing sites vary widely, moorings, serviced docking areas, access to drinking water and ice machines continue to be the most common services provided. Other services provided in select countries include refrigerated warehouses, fish markets, gear storage, fuel, electronic devices for data collection, medical, social and administrative premises, and scales for weighing catch.

Finally, the 2022 questionnaire posed another new question on whether CPCs had developed adaptation measures specific to SSF in order to cope with climate change impacts. Five CPCs indicated that they had, while one CPC (Egypt) indicated that it had included SSF within the framework of its nationally determined contributions ahead of the twenty-seventh session of the Conference of the Parties of the United Nations Framework Convention on Climate Change (Sharm el-Sheikh Climate Change Conference). Noting the growing presence of non-indigenous species, partly as a result of climate change, six CPCs indicated having taken additional action to prepare specific plans for the adaptation to and mitigation of non-indigenous species (adding to the seven CPCs that had already reported having prepared such plans in 2020). Four CPCs in particular have also prepared plans for the valorization of non-indigenous species caught by SSF.

Promoting sustainable small-scale fisheries livelihoods and social development

Small-scale fisheries are responsible for generating the highest onboard employment of any fishing sector in the region (see Chapter 3). Moreover, SSF support a significant number of jobs along the value chain, from net repair and shore-based fishing to fish processing and marketing. These jobs are also where the majority of women are found working in fisheries. As such, SSF are closely knit into the local economies of many coastal communities, providing fresh and local fish and often supporting local restaurant and tourism activities. Recognizing these roles, the 2022 questionnaire also sought to evaluate advances in supporting SSF livelihoods along the value chain, including improvements in decent work and the role of women. Additional questions were added to further understand how technology or other innovative tools may have been employed to enhance the resilience of the sector, as well as whether social protection had been extended to SSF stakeholders and whether measures had been implemented to support gender equity in the sector.

With regard to the available knowledge on SSF value chains, only two CPCs reported having carried out SSF value chain studies since 2020: a national-level value chain study in Montenegro and a local-level study of common octopus (*Octopus vulgaris*) SSF in the Northern Cyclades islands in Greece. These two countries add their studies to the five CPCs who, in 2020, reported having conducted a national or local SSF value chain assessment; this low number highlights the limited overall knowledge of SSF value chains in the region. Similarly, limited progress has been made in terms of training or assistance provided to small-scale fishers on catch handling and preservation. Only France has reported providing such training since 2020, i.e. integrating modules on processing and handling of catch into the approved training for new fishing vessel personnel. Finally, despite the WGSSF recognizing the role that technological innovation could play in supporting the resilience of SSF value chains, no countries reported having implemented concrete initiatives on this topic.

Access to social protection is a main pillar of decent work, and, as underscored by the COVID-19 pandemic, investing in social protection can provide vital support to shore up the resilience of the sector in times of crisis. Since 2020, meaningful progress has been made in improving social protection coverage. Health insurance and old age pensions continue to be the social protection programmes showing the greatest coverage for small-scale fishers. Seventeen CPCs reported that all or some small-scale fishers have access to health insurance (representing 71 percent of all CPCs – a net increase of one CPC since 2020) (Figure 84), while 16 CPCs reported that all or some small-scale fishers have access to old age pensions (representing 67 percent of all CPCs – a net increase of two CPCs since 2020) (Figure 85). Although unemployment coverage remains somewhat

FIGURE 84. Percentage of GFCM contracting parties and cooperating non-contracting parties providing small-scale fishers with access to health coverage

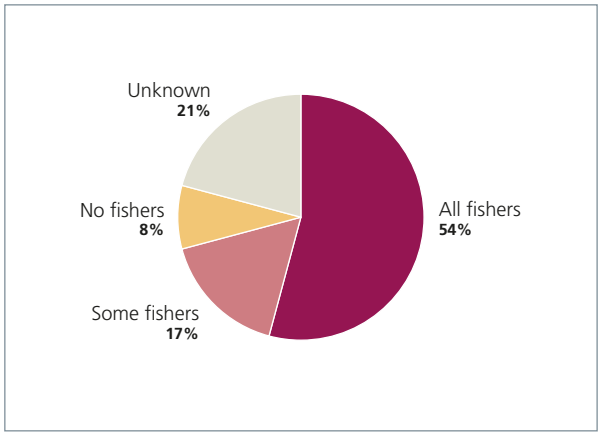


FIGURE 85. Percentage of GFCM contracting parties and cooperating non-contracting parties providing small-scale fishers with access to old age pensions

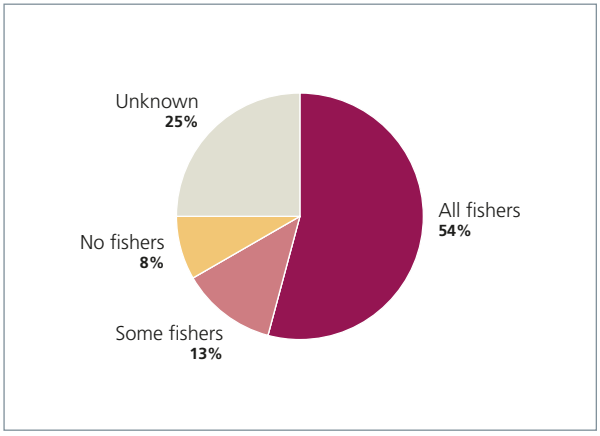
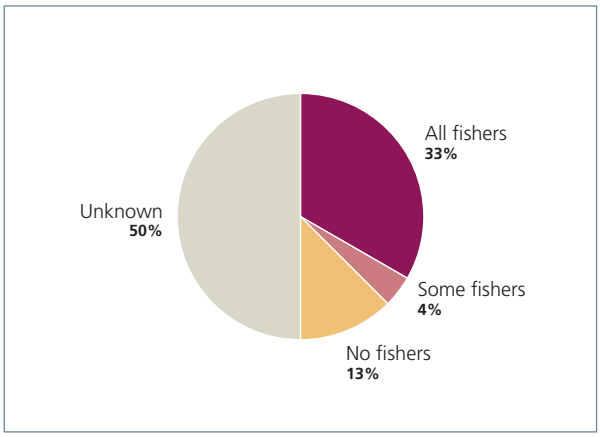


FIGURE 86. Percentage of GFCM contracting parties and cooperating non-contracting parties providing small-scale fishers with access to unemployment insurance



limited, with only nine CPCs (38 percent of all CPCs) reporting that all or some small-scale fishers have access to unemployment benefits (Figure 86), it is nevertheless the social protection category that has seen the greatest increase in coverage since 2020 (with three additional CPCs introducing coverage). Extending unemployment coverage was one tool employed by CPCs during the height of the pandemic to compensate fishers who were prevented from carrying out their activities due to lockdowns and social distancing restrictions. Furthermore, since 2020, some countries have taken steps to improve existing national social protection programmes, better adapting them to the realities of the sector. For example, Morocco has introduced an amendment to its social security legislation in order to better account for the seasonality of SSF activities.

To accurately evaluate the role of women in the SSF sector, collecting gender-disaggregated data is key. However, as observed previously in this chapter, the percentage of countries carrying out data collection in this way remains low for non-vessel-based activities and for the post-harvest sector. In addition to assessing the status of gender-disaggregated data, the questionnaire also examined the engagement of women in SSF decision-making processes and noted that, within both SSF organizations and fisheries administrations, the percentage of women in decision-making roles remains limited and at similar levels to the 2020 baseline. Five CPCs reported women in leadership roles (bureau positions) in their country's SSF organizations and two of these five reported that the number of women in these positions had increased since 2020. Eleven CPCs reported women in senior positions in fisheries administrations (up from ten CPCs in 2020), and three of these CPCs noted that the percentage of women in these positions had also increased since 2020. Finally, six CPCs (25 percent of all CPCs) reported adopting specific measures to facilitate the equal participation of women in SSF activities. Some initiatives to this end include the introduction of coaching and support programmes for women, the implementation of measures encouraging women to occupy decision-making positions and the establishment of dedicated female fishers' committees or societies within fisheries cooperatives. Nevertheless, there remains a high no-response rate to these questions on the role of women, indicating a continued paucity of available information on this topic.

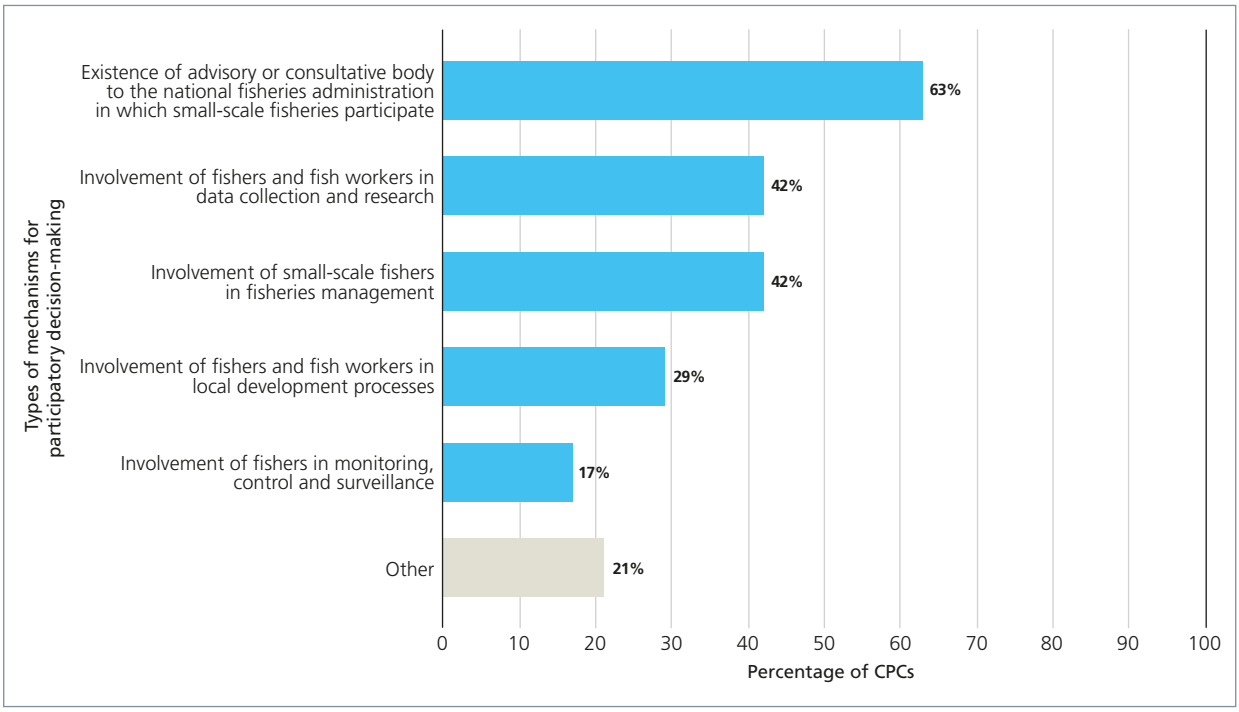
Empowering small-scale fisheries stakeholders

Building from the baseline analysis, the 2022 questionnaire also attempted to identify advances in engaging SSF stakeholders in RPOA-SSF implementation, as well as capacity-building opportunities being provided at the CPC level.

Co-management is an important tool for promoting fisher engagement in management processes, and as mentioned previously, notable progress has been made in the number of CPCs introducing new co-management initiatives. There are, however, other ways to facilitate SSF stakeholder engagement in the decision-making process, and the 2022 questionnaire sought to shed light on some of these mechanisms. In 2022, 18 CPCs (75 percent of all CPCs) indicated having established mechanisms for small-scale fishers and fish workers to take part in decision-making. This represents a slight increase from the baseline, when 17 CPCs indicated having such mechanisms. Five CPCs also noted having taken steps to actively promote these participatory mechanisms among small-scale fishers to encourage their engagement with these processes by, for example, forwarding relevant information to SSF organizations and organizing specific training, meetings and seminars with small-scale fishers.

With respect to specific forms of engagement of SSF actors in decision-making processes (Figure 87), no change was noted in the number

FIGURE 87. Percentage of GFCM contracting parties and cooperating non-contracting parties with mechanisms in place to engage small-scale fisheries stakeholders in decision-making



of CPCs with advisory or consultative bodies in which small-scale fishers and/or fish workers participate (15 CPCs; 63 percent of all CPCs). Similarly, the level of involvement of small-scale fishers in fisheries management (at the fishery level) remains unchanged from 2020, with ten CPCs (42 percent of all CPCs) indicating such arrangements. However, one CPC has reported advances in involving fishers and fish workers in local development processes since 2020 (making a total of seven CPCs; 29 percent of all CPCs). Progress has also been made in terms of involving fishers in MCS mechanisms, with four CPCs now indicating that fishers are engaged in MCS activities, compared with only two CPCs in 2020. Progress on these topics has nevertheless been slow, likely resulting in part from the COVID-19 pandemic, which hampered the ability of CPCs to undertake field work and connect fishers with researchers and policy-makers.

At the regional level, progress has been made to provide capacity-building opportunities to SSF by increasing options for SSF organizations to participate in GFCM initiatives, providing ad hoc training and workshops (Box 18) and improving communication with stakeholders to report on the outcomes of scientific work and research programmes.

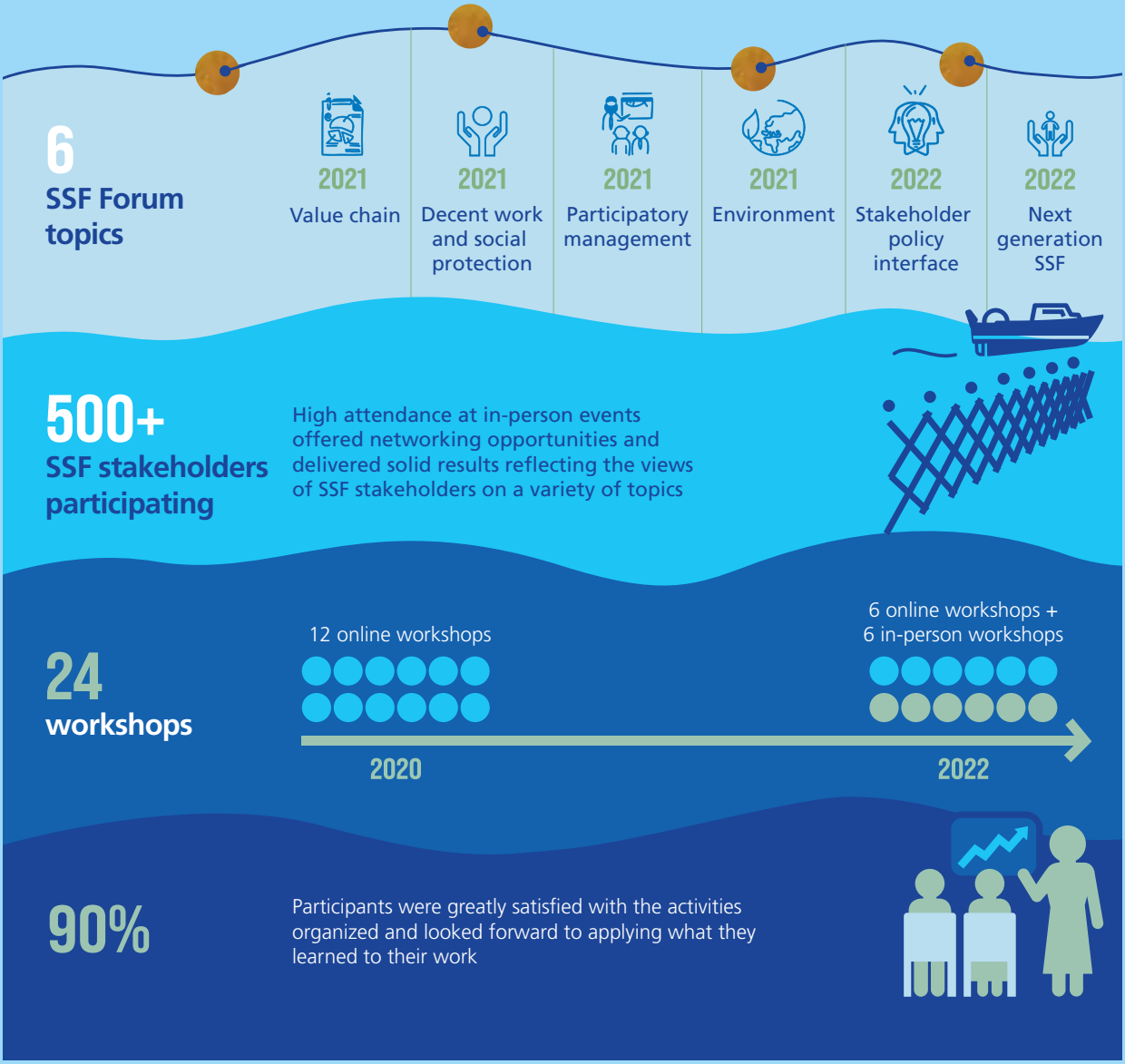
The circulated questionnaire also aimed to understand ongoing efforts to engage stakeholders in capacity building at the national level. While 15 of the 16 CPCs responding to the questionnaire indicated knowing about the SSF Forum, less than half (seven CPCs) have promoted it among their SSF communities, leaving room for improvement. Furthermore, only five CPCs indicated having carried out new training programmes for small-scale fishers or fish workers at the national level since 2020. Considering the importance of engaging younger generations, the questionnaire sought to understand whether CPCs had developed capacity-building programmes targeting young men and women. Five CPCs (21 percent of all CPCs) reported having prepared such programmes to teach and raise awareness about the SSF sector. Of these five CPCs, three have made efforts to engage young people through dedicated education and training programmes, three CPCs have been in contact with SSF communities on this topic and two CPCs have implemented initiatives to raise awareness about the SSF sector in local schools.

Box 18. The Small-Scale Fishers' Forum

The Small-Scale Fishers' Forum (SSF Forum)[1] was conceived of as a place for small-scale fishers and fish workers from the Mediterranean and Black Sea region to come together, share good practices and learn from one another. The initiative responds to recommendations made within the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF)[2] to facilitate education and training opportunities for small-scale fisheries (SSF) stakeholders to develop fisheries-specific skills and policy knowledge and share innovative solutions to challenges faced by the SSF sector. The SSF Forum is organized together with the partners of the Friends of SSF platform and consists of a series of workshops, which may take the form of classroom learning, in-the-field experience and/or peer-to-peer exchanges, as relevant.

[1] **FAO.** 2022. SSF Forum. In: *General Fisheries Commission for the Mediterranean*. Rome. Cited 21 November 2022. https://www.fao.org/gfcm/activities/fisheries/small-scale-fisheries/ssfforum/en/

[2] **FAO.** 2021. *The Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://www.fao.org/3/cb7838en/cb7838en.pdf



ADVANCES, CHALLENGES AND NEXT STEPS FOR IMPLEMENTING THE REGIONAL PLAN OF ACTION FOR SMALL-SCALE FISHERIES IN THE MEDITERRANEAN AND THE BLACK SEA

The updated RPOA-SSF monitoring framework questionnaire provided an opportunity to take stock of progress in relation to the objectives of the RPOA-SSF. While important advances have been made on some priority topics of the RPOA-SSF, the results of the questionnaire also highlighted areas where only modest improvements had occurred and others where progress had stalled altogether.

The analysis presented in this chapter shows good progress with respect to SSF management, social protection access and engagement of stakeholders. In particular, with respect to SSF management, important advances have been made in terms of the number of CPCs introducing new initiatives towards co-management or other participatory management arrangements. Additionally, CPCs are taking positive steps towards securing access to resources for SSF by increasing the number of landing sites dedicated to SSF. Likewise, advances have been made in identifying priority species for SSF, and many countries are already well positioned with data collection systems to assess these stocks. With respect to social protection, significant advances have helped to improve small-scale fishers' access to and coverage by social protection programmes. These advances reflect an increasing awareness among CPCs of the essential role of social protection programmes in supporting the resilience of the SSF sector, including to weather crises such as the COVID-19 pandemic. Finally, with respect to engaging SSF stakeholders, the analysis shows that progress has been made in participatory processes and capacity-building initiatives at the regional level.

Modest improvements are also evident with respect to data collection, engagement of fishers at the local level, addressing climate change and promoting the role of women in leadership roles. The number of countries with an obligation to report landings – thus satisfying a minimum requirement for data collection – is increasing, as is the number of countries collecting gender-disaggregated employment data. Some CPCs have also taken steps to better engage SSF in participatory decision-making and MCS processes at the local level, while other CPCs have made efforts to address climate change impacts on SSF. In addition, limited progress has been seen in increasing the representation of women in leadership positions, although the number of non-responses to questions regarding women in SSF points to a general need for more concerted tracking of the contributions of women to the sector. While progress on these topics is applauded, accelerated efforts are required to stay on track towards meeting the targets set.

Finally, the analysis brought to light important shortcomings in the implementation of the RPOA-SSF to date. Key topics requiring intensified action to maintain the possibility of meeting the RPOA-SSF's objectives include ensuring that all CPCs have up-to-date fleet registers covering the full SSF sector, enhancing the collection of data for non-vessel-based SSF and the post-harvest sector, and addressing SSF value chains by both clearly identifying the status quo via relevant studies, as well as implementing innovative solutions to bolster the profitability of the sector.

It is important to note that the RPOA-SSF monitoring framework questionnaire primarily seeks to identify progress made in terms of the number of CPCs addressing select topics, but it may lack a more nuanced analysis of the effectiveness of actions taken. For example, the questionnaire can reveal whether a CPC has introduced a co-management arrangement, but in its current form, it is not able to evaluate how effective that co-management arrangement may be. For a more well-rounded vision of the status of implementation of the RPOA-SSF, a follow-up questionnaire was therefore circulated to CPCs to solicit information about their experiences, including their perception of progress made and challenges faced, as well as their future priorities and support that may be needed.

In general, the perception of CPCs regarding progress mirrored the analysis carried out for this chapter. On the one hand, CPCs perceived that the most progress had been made in relation to scientific research, SSF data collection, participation of SSF in decision-making, and to a lesser extent, SSF management measures. On the other hand, the consensus was that less progress had been made regarding the role of women, capacity development and value chains.

Box 19. Small-Scale Fisheries Summit in celebration of the International Year of Artisanal Fisheries and Aquaculture 2022

The United Nations General Assembly declared 2022 the International Year of Artisanal Fisheries and Aquaculture (IYAFA 2022). The objective of IYAFA 2022 celebrations was to focus world attention on the role that small-scale fishers, fish farmers and fish workers play in food security and nutrition, poverty eradication and sustainable natural resource use, thereby promoting global understanding and action to support them. It was also an opportunity to enhance dialogue between different actors, raise awareness of the role of small-scale fisheries (SSF), strengthen the science–policy interface, empower stakeholders to take action and strengthen or build partnerships.

In the context of celebrating IYAFA 2022, a Small-Scale Fisheries Summit (SSF Summit) was organized on 3–4 September 2022 in Rome, Italy, by the Working Group on Fisheries of the International Planning Committee for Food Sovereignty (IPC), the Small-Scale Fisheries Resource and Collaboration Hub (SSF Hub) and the Friends of Small-Scale Fisheries (Friends of SSF) platform, with support from FAO. This SSF Summit was held prior to the FAO Committee on Fisheries (COFI), organized from 5 to 9 September 2022, providing an opportunity for SSF stakeholders in attendance to issue key messages for consideration by COFI delegations. The SSF Summit aimed to promote dialogue and collaboration between and among small-scale fishers, fish farmers, fish workers, governments and other key partners along the value chain and to further strengthen their capacity to enhance sustainability in fisheries and aquaculture and to improve their social development and well-being.

On the occasion of the SSF Summit, the Friends of SSF platform – via the GFCM and the Mediterranean Marine Initiative of the World Wildlife Fund (WWF) – organized a session titled "Mediterranean and Black Sea SSF dialogue", which was conceived of as an open dialogue with SSF organizations in the region, offering fishers a space to reflect on and discuss the priorities, challenges, opportunities and future needs related to the continued implementation of the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea (RPOA-SSF). [1] Numerous interventions were made by more than 20 fishers and fisher representatives from the Mediterranean and Black Sea region, with discussions centring on pressing topics such as climate change and generational turnover.

The main conclusions of the SSF Summit's Mediterranean and Black Sea dialogue were:

- In the wake of the COVID-19 pandemic, full implementation of the RPOA-SSF is more necessary than ever to support a sustainable and viable SSF sector.
- The main challenges faced by small-scale fishers in the region include: climate change impacts, such as rising sea temperatures and an increasing presence of non-indigenous species; marine pollution; competition with industrial and recreational fisheries; the need for infrastructure adapted to small-scale fisheries; the need to improve working conditions (including for women fishers); the need to ensure economic viability of the sector through vibrant and fair value chains; and a lack of generational turnover in the sector.
- Mediterranean and Black Sea fishers are willing to be innovative and are open to learning and exchanging experiences with each other. They stand ready to join forces in order to participate in projects and test new solutions.
- Regional actors, such as the GFCM, the WWF Mediterranean Marine Initiative and other members of the Friends of SSF, have a role to play in supporting SSF organizations by facilitating exchanges, providing technical assistance and building capacity to engage with projects, donors and decision-makers in productive and effective ways.

As a concrete outcome of the session, a proposal was made to ensure the regular occurrence of an event gathering Mediterranean and Black Sea SSF organizations together in order to discuss, exchange and identify priorities for common action.

[1] **FAO.** 2021. *The Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://www.fao.org/3/cb7838en/cb7838en.pdf

It is notable that CPCs also perceived limited progress on decent work, whereas this was one area where the analysis showed considerable progress.

Respondent CPCs indicated that a lack of progress was primarily due to weak capacity, insufficient funding and a lack of understanding on how to take action. Likewise, respondent CPCs cited additional barriers to implementation, including the COVID-19 pandemic, national political crises, limited human resources and new challenges threatening the sector, such as non-indigenous species and rising fuel costs. In order to better improve the implementation of the RPOA-SSF at the national level, CPCs responding to the follow-up questionnaire cited the need for support in terms of capacity building, improved knowledge of the sector and, to a lesser extent, material and logistical support. For example, CPCs cited the need to better link SSF organizations in the region to share best practices and innovations, as well as to provide direct support to fishers in the form of training, livelihood diversification and social protection access.

An important step in this direction may be to give SSF stakeholders a more active role in the development and design of capacity-building programmes, such as the SSF Forum, as concluded during the dedicated SSF Summit held on the occasion of the International Year of Artisanal Fisheries and Aquaculture (IYAFA 2022) (Box 19). This chapter highlights that CPCs are moving in the right direction towards the implementation of the RPOA-SSF, although the level of progress varies and remains slow on many topics. Certainly, Mediterranean and Black Sea countries have all experienced setbacks due to the COVID-19 pandemic, but as they move on from the pandemic, accelerated action is needed if CPCs are to meet the ambitious targets set by the RPOA-SSF for 2028.

7. Fisheries management

This chapter provides a summary of the fisheries management measures adopted at the regional and subregional levels in the Mediterranean and the Black Sea since the last edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020a). It focuses on the most relevant multiannual management plans for demersal and small pelagic species in the Mediterranean and the Black Sea, as well as on new measures adopted and mitigation measures for the conservation of elasmobranchs, sea turtles, seabirds and cetaceans (Table 17). The chapter also touches on additional measures to implement mininimum conservation reference sizes (MCRS), as well as on the mitigation of fisheries impacts for the conservation of sturgeons in the Black Sea.

This chapter also describes ongoing and newly launched GFCM research programmes, as well as pilot studies and projects, which represent an important tool for the collection of scientific information and data by GFCM contracting parties and cooperating non contracting-parties (CPCs) to support the identification and implementation of new fisheries management measures (e.g. on European eel [*Anguilla anguilla*]; Box 20) and the development of existing transitional measures into long-term ones.

Regarding spatial management measures, this chapter describes recent decisions regarding fisheries restricted areas (FRAs), including the adoption or upgrading of new or existing FRAs and a roadmap for the establishment of a new FRA in the southern Adriatic Sea (GSA 18). In addition, it outlines the advances made

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

	Geographical subareas	Main management and conservation measures																						Research programmes and pilot projects
		Authorized fishing gear	Authorized landing ports	Bycatch reporting obligation	Catch certification scheme	Catch limit/total allowable catch	Catch record	Discard landing obligation	Essential fish habitat protection through a fisheries restricted area	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 guides	Harvest control rule/ fishing mortality target	International inspection plan	Logbook/vessel monitoring system	Minimum conservation reference size	Precautionary closures	Protection framework	Spatial/temporal restrictions to fisheries (other than fisheries restricted areas)	Transshipment prohibition	
Fisheries																								
Blackspot seabream	1–3		43/2019/2 44/2021/4	43/2019/2 44/2021/4			41/2017/2 43/2019/2 44/2021/4				41/2017/2 43/2019/2 44/2021/4	41/2017/2 43/2019/2 44/2021/4	41/2017/2 43/2019/2 44/2021/4	43/2019/2 44/2021/4				43/2019/2 44/2021/4	41/2017/2 43/2019/2 44/2021/4 *44/2021/2				41/2017/2 43/2019/2 44/2021/4	
Blue crabs	1–27																							42/2018/7
Common dolphinfish	1–27						43/2019/1 44/2021/11				43/2019/1 44/2021/11			43/2019/1 44/2021/11				35/2011/1 *43/2019/3 33/2009/7				30/2006/2		43/2019/1 44/2021/11
Deep-water red shrimp	19–21		42/2018/4 44/2021/8	42/2018/4 44/2021/8			42/2018/4 44/2021/8				42/2018/4 44/2021/8	42/2018/4 44/2021/8	42/2018/4 44/2021/8				42/2018/4 44/2021/8	42/2018/4 44/2021/8					42/2018/4 44/2021/8	
	24–27		42/2018/3 44/2021/6	42/2018/3 44/2021/6			42/2018/3 44/2021/6				42/2018/3 44/2021/6	42/2018/3 44/2021/6	42/2018/3 44/2021/6				42/2018/3 44/2021/6	42/2018/3 44/2021/6					42/2018/3 44/2021/6	
	12–16		43/2019/6 44/2021/7								43/2019/6 44/2021/7		43/2019/6 44/2021/7					43/2019/6 44/2021/7					43/2019/6 44/2021/7	
Demersal species	7								33/2009/1				33/2009/1						*44/2021/2					
	12–16		42/2018/5 44/2021/12				42/2018/5 44/2021/12		42/2018/5 44/2021/12		42/2018/5 44/2021/12	42/2018/5 44/2021/12	42/2018/5 44/2021/12			42/2018/5 44/2021/12	42/2018/5 42/2018/6 44/2021/12	42/2018/5 44/2021/12	42/2018/5 44/2021/12 *44/2021/2			42/2018/5 44/2021/12	42/2018/5 44/2021/12	44/2021/12
	17–18			43/2019/5			43/2019/5		43/2019/5		43/2019/5	43/2019/5 44/2021/1	43/2019/5 44/2021/1				43/2019/5	43/2019/5	43/2019/5 *44/2021/2			43/2019/5	43/2019/5	
European anchovy and sardine	17–18					40/2016/3 44/2021/20	37/2013/1 44/2021/20		42/2018/8 44/2021/20		37/2013/1 40/2016/3 42/2018/8 44/2021/20	37/2013/1 44/2021/20	40/2016/3 42/2018/8 44/2021/20			37/2013/1 44/2021/20	42/2018/1 44/2021/20	37/2013/1 44/2021/20	37/2013/1 *44/2021/2			38/2014/1 39/2015/1 40/2016/3 42/2018/8 44/2021/20		
European eel	1–27	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	29		44/2021/9	44/2021/10			39/2015/4 36/2012/3 42/2018/2				44/2021/10	39/2015/4 44/2021/10						39/2015/4 44/2021/10	39/2015/4			36/2012/3 42/2018/2	44/2021/10	44/2021/10
Rapa whelk	29																							42/2018/9
Red coral	1–27	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	43/2019/4
Sprat	29		44/2021/9	44/2021/9			44/2021/9	44/2021/9			44/2021/9	44/2021/9						44/2021/9				44/2021/10		
Sturgeon	29																							*44/2021/5
Turbot	29	37/2013/2	39/2015/3	43/2019/3 41/2017/4	44/2021/17	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	1–29			36/2012/2											Available						36/2012/2			44/2021/15
	29													37/2013/2										
Monk seal	1–27			35/2011/5																	35/2011/5		35/2011/5	
Seabirds	1–29			35/2011/3											Available						35/2011/3			44/2021/13
Sea turtles	1–29			35/2011/4											Available						35/2011/4		35/2011/4	44/2021/14
Conservation-priority sharks and rays	1–27					44/2021/16									Available						44/2021/16			44/2021/16
	1–29			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	1–29			*43/2019/6											Available							29/2005/1		
	18																					44/2021/3		*44/2021/3
	19																					30/2006/3		
	25																					30/2006/3		
	26																					30/2006/3		

Note: * indicates GFCM resolutions.

in populating the GFCM database on sensitive benthic habitats and species, which was launched in 2020 as well as the creation of a new database on national fisheries closures.

The information presented in this chapter originates from the outcomes of relevant GFCM expert meetings held in 2020–2021 and from the *Compendium of GFCM decisions* (GFCM, 2021), whose fisheries and conservation management measures are summarized in Table 17.

MANAGEMENT MEASURES

Since the adoption, in 2013, of the first comprehensive GFCM multiannual management plan for small pelagic fisheries in the Adriatic Sea, the GFCM has made significant advances with 10 adaptive multiannual management plans in place as of 2022. While some of these plans are structured and outline specific long-term measures (e.g. for the protection of Black Sea turbot [*Scophthalmus maximus*]), others are incipient management plans that set out to progress in a step-wise manner from preliminary transitional measures to future long-term adaptive management plans informed by the collection of new or additional scientific data (Table 17). Accordingly, multiannual management plans all specify adaptive mechanisms to be implemented in order to achieve specific objectives within desired time frames 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 revision of six multiannual management plans, as well as the introduction of eight 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 over the past two years.

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

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. In 2019, in line with the precautionary principle, the GFCM adopted a recommendation[15] setting management measures for the use of anchored fish aggregating devices (FADs) in common dolphinfish fisheries in the Mediterranean Sea (FAO, 2020a), which was further amended in 2021.[16] Recommendation GFCM/43/2019/1 established, for 2020 and 2021, transitional management measures applicable to fishing vessels of CPCs exploiting common dolphinfish in the GFCM area of application. In 2021, the application of these transitional measures was extended to 2022 and 2023, and the establishment of a GFCM working group in 2022 was requested in order to develop a multiannual management plan for common dolphinfish fisheries that includes measures for the management of FADs, taking into consideration socioeconomic elements, as well as efforts made by CPCs to manage relevant fisheries and to apply, in some cases, stricter rules than those defined in Recommendation GFCM/43/2019/1.

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

Two recommendations guide the management of blackspot seabream (*Pagellus bogaraveo*) in the Alboran Sea. These decisions were adopted in 2017[17] and 2019[18] based on the outcomes of a benchmark assessment and technical elements in support of the management of this fishery (FAO, 2020a), and their provisions were applicable until 2021. Recommendation GFCM/43/2019/4 was then further amended in 2021 and its provisions extended to 2022, requesting the GFCM to adopt long-term measures in 2022 towards the sustainable exploitation of blackspot seabream in the Alboran Sea and, when appropriate, applying fishing effort limitations, catch limits and seasonal closures to protect spawners and juveniles.

[15] 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.

[16] GFCM/44/2021/11 on management measures for the use of anchored fish aggregating devices in common dolphinfish fisheries in the Mediterranean Sea, amending Recommendation GFCM/43/2019/1.

[17] 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.

[18] 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).

Turbot fisheries in the Black Sea (geographical subarea 29)

Turbot (*Scophthalmus maximus*) is a GFCM priority species in the Black Sea, and several recommendations to regulate the Black Sea turbot fishery have been adopted over the years, ultimately resulting in the adoption of a multiannual management plan in 2017[19] (FAO, 2020a). It is the only fishery in the GFCM area of application managed by a total allowable catch (TAC) and quota system.[20] In 2021, the GFCM adopted a specific framework[21] on a catch documentation scheme (CDS) for turbot to identify the origins of catch in the Black Sea. According to this decision, a GFCM CDS must be implemented by CPCs, via catch certificates, to identify the origin of turbot catch in geographical subarea (GSA) 29 at all the steps of the supply chain, accompanying all landings, imports, exports and re-exports of turbot, following a set of provided criteria. Such a scheme is also meant to certify that catch occurred in accordance with the conservation and management measures established in 2017[7] and in 2019.[8] Recommendation GFCM/44/2021/17 also foresees a two-year (2022–2023) transitional period or pilot phase, during which the CDS will be gradually implemented in each CPC, to the extent possible, taking into account national specificities. In parallel with the pilot phase, the Working Group on Integrated MCS Measures and Catch Documentation Scheme for turbot fisheries in the Black Sea is tasked with submitting to the Compliance Committee its recommendations for a permanent GFCM CDS for turbot in 2023.

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

In order to address issues related to the Adriatic Sea's multispecies demersal fishery, a multiannual management plan[22] 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 (GSAs 17–18) was adopted in 2019. It foresaw an initial transitional fishing effort regime in 2020–2021 aimed at decreasing effort by set percentages (12 percent for otter trawls and 16 percent for beam trawls in comparison to the annual effort of 2015 or the average of 2015–2018), followed by yearly fishing effort quotas in 2022–2026. This management plan was the first to include a detailed effort regime in the Mediterranean Sea, and in order to advance on its implementation, a recommendation was adopted in 2021,[23] foreseeing a progressive linear annual reduction in fishing mortality (F) towards the maximum sustainable yield (F_{MSY}) target in 2026. With this in mind, and based on the most recent scientific advice, the overall reduction in fishing effort in 2022 (1 January–31 December 2022) was set to 7 percent for bottom otter trawls and 3 percent for beam trawls. It is expected that effort quotas will be updated each year until 2026, in accordance with scientific advice.

Sustainable exploitation of small pelagic stocks in the Adriatic Sea (geographical subareas 17–18)

The first multiannual management plan for small pelagic fisheries in the Adriatic Sea was adopted in 2013.[24] It established management measures and harvest control rules for fisheries targeting sardine (*Sardina pilchardus*) and European anchovy (*Engraulis encrasicolus*) in the northern Adriatic Sea (GSA 17) and transitional conservation measures for small pelagic fisheries in the southern Adriatic Sea (GSA 18); further precautionary and emergency measures were established for 2015 and 2016. Since then, additional recommendations were adopted establishing supplementary precautionary and emergency measures for this fishery in both GSAs 17 and 18 for 2017–2018 and for 2019–2021. In 2021, a new management plan[25]

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

[20] 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).

[21] Recommendation GFCM/44/2021/17 on a catch certificate scheme for turbot in the Black Sea (geographical subarea 29).

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

[23] Recommendation GFCM/44/2021/1 on the establishment of a fishing effort regime for key demersal stocks in the Adriatic Sea (geographical subareas 17 to 18).

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

[25] Recommendation GFCM/44/2021/20 on a multiannual management plan for the sustainable exploitation of small pelagic stocks in the Adriatic Sea (geographical subareas 17 and 18).

was adopted with the aim of providing high long-term yields consistent with maximum sustainable yield (MSY) and to guarantee a low risk of stock collapse while maintaining the sustainability and relative stability of fisheries and dependent industries. The management plan is based on a two-step approach whereby during the first two years (2022–2023) – with the possibility of adding a third year (2024) – a set of transitional precautionary management measures shall be developed in order to ensure that, while minimizing socioeconomic impacts and finalizing scientific advice from the Scientific Advisory Committee on Fisheries (SAC), the relevant stocks and fisheries are capable of progressing towards biologically sustainable levels. Transitional measures include catch limits and spatio-temporal measures. Thus, in 2022 and 2023, a transitional fishing regime is established foreseeing national or joint catch limits aligned with annual reductions of 5 percent for European anchovy and 8 percent for sardine in 2022, and 5 percent for European anchovy and 9 percent for sardine in 2023. For Albania and Montenegro, whose declared catch fell under 2 500 tonnes in 2014, joint catch limits are established for 2022 and 2023, over which the same reductions apply; none of these CPCs shall individually exceed 70 percent of the total joint limit at any time. Following the transitional period, on the basis of new scientific data, the SAC will annually evaluate the state of stocks and, in accordance with the harvest control rules specified in Recommendation GFCM/44/2021/20 (as well as additional ones, if identified), will propose further measures and advisable yearly catch limits per species for 2024 or 2025–2029. The recommendation also requires that a mechanism is established for the fair and equitable allocation of key Adriatic small pelagics resting on principles similar to those determined for Black Sea turbot in 2019 (Box 22 in FAO, 2020a). In order to provide timely advice on management measures, Recommendation GFCM/44/2021/20 requests that annual advice be formulated on the status of these two key stocks from 2022 based on year n-1 data compared to the advice year, thus reducing the time that elapses between data collection and advice, which is a particularly important consideration for short-lived, environmentally-driven species such as these.

Demersal fisheries in the Strait of Sicily (geographical subareas 12–16)

In 2018, a multiannual management plan for demersal fisheries[26] was endorsed by the GFCM to ensure that exploitation levels of European hake and deep-water rose shrimp fishing mortality (F) targets were directed towards achieving the maximum sustainable yield (F_{MSY}). This recommendation included, among others, the following measures: protection of nursery areas and essential fish habitats (EFH) of key stocks through the establishment of additional FRAs and temporal closures; gradual elimination of discards; addressing illegal, unreported and unregulated (IUU) fishing activities; and adjustments made to the fishing capacity of the fleets to achieve fishing mortality levels consistent with MSY (FAO, 2020a). In 2021, the duration of this management plan was extended to the end of 2022,[27] pending a GFCM decision on its further development.

Trawl fisheries targeting giant red shrimp and blue and red shrimp in the eastern-central Mediterranean (geographical subareas 12–16; 19–27)

In 2018, the GFCM adopted two recommendations[28,29] – one for the Levant Sea (GSAs 24–27) and one for the Ionian Sea (GSAs 19–21) – on multiannual management plans for sustainable trawl fisheries targeting giant red shrimp (*Aristaeomorpha foliacea*) and blue and red shrimp (*Aristeus antennatus*). Similarly, in 2019, a recommendation[30] was adopted to establish management measures for sustainable trawl fishing activities targeting these two species in the Strait of Sicily (GSAs 12–16). These recommendations aimed at ensuring that the

[26] 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.

[27] Recommendation GFCM/44/2021/12 on a multiannual management plan for bottom trawl fisheries exploiting demersal stocks in the Strait of Sicily (geographical subareas 12 to 16), amending Recommendation GFCM/42/2018/5.

[28] 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 to 27).

[29] 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 to 21).

[30] 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 to 16).

stocks and the fisheries were kept at biologically sustainable levels, while preparing for future management plans (FAO, 2018, 2020a). In 2021, three recommendations were adopted, amending previous ones and foreseeing two steps: 1) the creation of a working group tasked with developing measures for the management of these key species in the Levant Sea[31] and the Ionian Sea,[32] taking into consideration the levels of historical catch and efforts made by CPCs to manage relevant fisheries towards the identification and application, in some cases, of stricter rules than those defined in the recommendation, while also accounting for socioeconomic considerations; and 2) the extension until 2022 of precautionary management measures for the Strait of Sicily.[33] The ultimate aim of these amendments was to provide a basis for the establishment of long-term multiannual management plans in 2022.

European sprat in the Black Sea (geographical subarea 29)

An important fishery for European sprat (*Sprattus sprattus*) is found in the Black Sea (GSA 29), with fleets from all coastal countries exploiting this resource to a lesser or greater extent and catch fluctuating between 29 000 tonnes and 120 000 tonnes over the past ten years (49 000 tonnes in 2021). The stock assessment of European sprat is currently undergoing a benchmark evaluation, but in most of the recent validated assessments, stock status has fluctuated between being in sustainable exploitation and in overexploitation, probably due to the complexity of environmental factors affecting populations of this species. In 2021, pending robust scientific advice from the Working Group on the Black Sea (WGBS), a recommendation[34] was adopted to establish transitional management measures for the sustainable exploitation of European sprat in the Black Sea consistent with the precautionary approach, preparing the groundwork for future management measures towards ensuring high long-term yields consistent with MSY, while guaranteeing a low risk of stock collapse and maintaining sustainable and relatively stable fisheries. The provisions of this recommendation include: 1) the need for annual advice on stock status, accounting for possible impacts of the climate on European sprat populations in the Black Sea; 2) the establishment of mechanisms to monitor and control the fleet targeting European sprat (i.e. lists of authorized vessels reporting operating days, operating area and total catch, a national fleet register, designated landing points, vessel monitoring systems [VMS] on vessels over 12 m length overall); and 3) the establishment of mechanisms to avoid discards (i.e. landing obligations and the possibility for CPCs to designate additional spatial/temporal restrictions or closures in order to protect juvenile aggregation areas).

Piked dogfish in the Black Sea (geographical subarea 29)

In 2015, the GFCM adopted a recommendation[35] foreseeing the development of management measures in line with the precautionary approach for Black Sea fisheries exploiting piked dogfish (*Squalus acanthias*) or significantly capturing it as bycatch. This first recommendation consisted of three parts, including provisions on: 1) a MCRS of 90 cm, accompanied by the live release of undersized individuals; 2) the reiterated need to reduce coastal trawl net fishing in order to better protect coastal sharks[36] and the identification of a minimum target percentage of fishing grounds to be covered by protective measures; and 3) monitoring, data collection and research (i.e recording information on fishing activities, catch data, incidental catch, release or discarding events, as well as the improvement of data collection). It also requested CPCs to engage in capacity-building efforts and other cooperative research activities to improve knowledge on piked dogfish biology, including population dynamics, migration, the identification of spawning and nursery areas, survival ratios, and any other characteristics that

[31] Recommendation GFCM/44/2021/6 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 to 27), amending Recommendation GFCM/42/2018/3.

[32] Recommendation GFCM/44/2021/8 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 to 21), amending Recommendation GFCM/42/2018/4.

[33] Recommendation GFCM/44/2021/7 on management measures for sustainable trawl fisheries targeting giant red shrimp and blue and red shrimp in the Strait of Sicily (geographical subareas 12 to 16), amending Recommendation GFCM/43/2019/6.

[34] Recommendation GFCM/44/2021/9 on management measures for the sustainable exploitation of sprat in the Black Sea (geographical subarea 29).

[35] Recommendation GFCM/39/2015/4 on management measures for piked dogfish in the Black Sea.

[36] Recommendation GFCM/36/2012/3 on fisheries management measures for the conservation of sharks and rays in the GFCM area of application.

could effectively support the implementation of management actions. Despite these measures, piked dogfish stocks have been consistently considered depleted and in need of a recovery plan in the Black Sea for the past eight years. The assessment of this species is still fraught by serious deficiencies in the availability and quality of data, with few countries (only Bulgaria at the moment) officially targeting piked dogfish commercially and little information on discards from other fisheries. Considering the vulnerability of piked dogfish to fishing impacts, owing to its longevity and low fecundity, the GFCM has considered this species a priority to be addressed and adopted a second recommendation in 2021[37] with the objective of establishing transitional management measures to prepare for a future multiannual management plan covering all fishing activities, while reducing the risk of the stock declining further in the absence of robust scientific advice. Beyond reiterating previously foreseen measures, this second recommendation first and foremost establishes, under the BlackSea4Fish project (Box 25 in FAO, 2020a), the implementation of the GFCM research programme on piked dogfish in the Black Sea (see section "GFCM research programmes, pilot studies and pilot projects") to collect and collate the necessary data in order to ensure annual scientific monitoring of the status of piked dogfish, as well as provide the basis for: 1) the establishment of temporal and spatial closures for piked dogfish fisheries during the reproduction season; 2) considering restocking as a management measure; 3) identifying measures to further reduce and mitigate bycatch; and, if needed, 4) reassessing the minimum landing size with the aim of defining a MCRS for piked dogfish. Finally, it foresees: the establishment of a fleet register of authorized fishing vessels with the collection of minimum data requirements (i.e. operating days, operating area and total catch); a freeze on fishing capacity or effort at the levels of 2015–2021; designated landing points; VMS on vessels over 12 m length overall; and other measures to deter IUU fishing.

[37] Recommendation GFCM/44/2021/10 on management measures for sustainable piked dogfish fisheries [in] the Black Sea (geographical subarea 29).

Additional mitigation measures for the conservation of elasmobranchs in the Mediterranean Sea

In 2021, complementing the provisions of the first recommendation on sharks and rays adopted in 2012[38] and amended in 2018,[39] the GFCM adopted a new recommendation[40] whereby CPCs are encouraged to take further action to improve the conservation status of elasmobranchs and adopt measures towards mitigating or eliminating the risk of incidental catch in fishing operations (see Chapter 4) and associated mortality in the Mediterranean Sea. This recommendation, in particular, addresses all elasmobranch species of the Mediterranean Sea listed in Annexes II and III of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol) of the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention) and includes the adoption of species-specific actions for the latter (Table 18).

Measures and actions requested of CPCs include: 1) adopting mitigation measures, including the establishment of an incentive system, as well as technical training and certification schemes for vessel captains; 2) conducting research to improve fishing gear, equipment and fishing techniques, with the aim of reducing elasmobranch bycatch mortality and increasing post-release survival rates; and 3) monitoring implemented measures to determine their efficacy. Specifically, these measures and actions may include: fishing gear modifications and alternative fishing gear types; improvements in fishing gear marking and detection; spatio-temporal fishing restrictions or closures; the implementation of potential bycatch thresholds; and the use of magnetic deterrent devices on the basis of scientific studies and after a cost–benefit evaluation. Contracting parties and cooperating non-contractong parties could also consider, on a voluntary basis, other forms of management, such as incentive-based management or market-based incentive management. For the shark species listed in Table 18, CPCs will also require fishing

[38] Recommendation GFCM/36/2012/3 on on fisheries management measures for the conservation of sharks and rays in the GFCM area of application.

[39] 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.

[40] Recommendation GFCM/44/2021/16 on additional mitigation measures for the conservation of elasmobranchs in the Mediterranean Sea.

TABLE 18. Elasmobranch species of the Mediterranean Sea listed in Annex III of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol)

Smooth-hound sharks (*Mustelus asterias, M. mustelus, M. punctulatus*)
Common thresher (A*lopias vulpinus*)
Sandbar shark (*Carcharhinus plumbeus*)
Gulper shark (*Centrophorus granulosus*)
Sharpnose sevengill shark (*Heptranchias perlo*)
Piked dogfish (*Squalus acanthias*)
Blue shark (*Prionace glauca*)

Source: **UNEP/MAP-SPA/RAC.** 2022. SPA/DB Protocol. In: *SPA/RAC Specially Protected Areas Regional Activity Centre.* Tunis. Cited 29 November 2022. https://www.rac-spa.org/sites/default/files/protocole_aspdb/protocol_eng.pdf

vessels incidentally capturing these species to limit bycatch to a maximum percentage of the total catch in weight or to no more than three specimens per fishing trip (or by vessel) in 2023, which has been set as the year when the SAC shall be called upon to assess the most up-to-date catch and composition data by species and the GFCM will agree on a maximum percentage. The SAC may also consider the adoption of a speciesspecific minimum and/or maximum landing size, taking into account gestation periods and reproductive strategies and considering limiting recreational fishing of elasmobranchs and/or restrictions on the catch, landing and sale of the species covered by Recommendation GFCM/44/2021/16. In order to improve the available information on bycatch through observation and monitoring programmes, the recommendation also requests that, by 2022, pilot projects are established for the species listed under Annex II and Annex III of the SPA/BD Protocol. By 2026, CPCs are asked to report on at least one action per species or genus or on at least five speciesspecific actions in total to improve the conservation status of elasmobranchs.

Mitigation of fisheries impacts for the conservation of cetaceans

The first recommendation addressing the protection of cetaceans in the GFCM area of application dates back to 2012,[41] while the first to specifically address the protection of cetaceans in the Black Sea was adopted in 2013.[42] More recently, a resolution and a new recommendation were adopted by the GFCM in 2019[43] and in 2021,[44] respectively. The latter requires CPCs to take further action to improve the conservation status of cetacean species and to make every effort to support global and regional actions investigating the most appropriate measures to mitigate bycatch and depredation, especially in fisheries with a high risk of bycatch (see Chapter 4) as identified by the SAC, and to implement them, as necessary, in close collaboration with relevant stakeholders. Such mitigation measures shall be accompanied by appropriate monitoring to determine their efficacy and may include fishing gear modifications and alternative fishing gear types, improvements in fishing gear marking and detection, spatio-temporal fishing restrictions or closures, the implementation of maximum potential bycatch thresholds, the use of acoustic deterrent devices and modifications in fishing behaviour and strategies. Contracting parties and cooperating non-contracting parties are also called on to further enhance data collection, monitoring and reporting mechanisms, including on the socioeconomic impacts of cetacean depredation on fisheries, through the development of a pilot project in 2023 leading towards the elaboration of appropriate compensation and bycatch mitigation measures.

Mitigation of fisheries impacts for the conservation of sea turtles

A first recommendation adopted in 2011[45] sought to ensure the protection of sea turtles and minimize their bycatch in fisheries (see Chapter 4). A new decision adopted in 2021[46] requests CPCs to take further action to improve the conservation status of sea turtle species and devise and implement measures to mitigate or eliminate the risk of incidental catch of sea turtles in fishing operations and associated mortality. Contracting parties and cooperating non-contracting parties are thus requested to enhance the reporting of data and information on the

[41] Recommendation GFCM/36/2012/2 on the mitigation of incidental catch of cetaceans in the GFCM area of application.

[42] 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.

[43] Resolution GFCM/43/2019/2 on enhancing the conservation of cetaceans in the GFCM area of application.

[44] Recommendation GFCM/44/2021/15 on the mitigation of fisheries impacts for the conservation of cetaceans.

[45] Recommendation GFCM/35/2011/4 on the incidental bycatch of sea turtles in fisheries in the GFCM area of application.

[46] Recommendation GFCM/44/2021/14 on the mitigation of fisheries impacts for the conservation of sea turtles.

incidental catch rates of sea turtles and take the necessary steps to implement existing legislation and measures to mitigate and, where possible, eliminate the incidental catch of sea turtles during fishing operations. These measures may include fishing gear modifications and alternative fishing gear types (e.g. the use of turtle excluder devices with sorting and shepherding devices), spatio-temporal fishing restrictions and closures (e.g. based on spatial recognition measures to identify sea turtle presence), improvements in fishing gear marking and detection, including acoustic reflectivity (e.g. through the use of coloured nets, light passive reflectors, thicker twine diameter, corks or other materials within the net, metal compounds with acoustic detection features such as barium sulphate, and illuminated nets with battery-operated light sticks), the implementation of maximum potential bycatch thresholds, and modifications in fishing behaviour and strategies (e.g. reduced soaking time, daytime retrieval of gear and setting hooks deeper than sea turtles' most common depth range of 40–100 m).

Mitigation of fisheries impacts for the conservation of seabirds in the Mediterranean Sea

Similarly to sea turtles, a recommendation adopted in 2021[47] complements a previous one adopted back in 2011[48] that aimed to ensure the protection of seabirds and minimize bycatch in fisheries (see Chapter 4). According to this new recommendation, CPCs should develop mechanisms ensuring that additional data are collected on the incidental catch of seabirds during fishing activities, establish measures to improve the conservation status of seabirds and minimize, mitigate and, where possible, eliminate unwanted interactions between fishing operations and seabirds, particularly for species listed under Annex II to the SPA/BD Protocol. In particular, they should develop conservation measures to ensure that the incidental catch of the critically endangered Balearic shearwater (*Puffinus mauretanicus*) during fishing activities in high-risk areas (to be defined by the SAC) is monitored and eliminated where possible. The ultimate aims of this recommendation are to: 1) improve the scientific, technical and socioeconomic knowledge of fisheries experiencing seabird bycatch by applying the measures adopted in 2011; 2) evaluate and develop transitional mitigation measures, in general and more specifically for areas with high incidental catch of Balearic shearwaters; 3) develop, if necessary and upon SAC advice, a protocol for the collection of data and the reporting of incidental seabird bycatch during fishing activities; and iv) implement pilot projects for seabird species with impaired conservation status in the Mediterranean and the Black Sea, such as the critically endangered Balearic shearwater, the vulnerable Yelkouan shearwater (*Puffinus yelkouan*), the vulnerable Audouin's gull (*Larus audouinii*) and Scopoli's shearwater (*Calonectris diomedea*). By 2024 at the latest, CPCs are required to evaluate the effectiveness of at least two transitional mitigation measures, which can come from within or outside a list of measures specified in the recommendation that includes setting fishing gear at night, using modified gear, encouraging the use of bird exclusion devices and releasing live-caught seabirds.

Minimum conservation reference size for priority stocks in the Mediterranean Sea

A resolution adopted in 2021[49] established a requirement of all CPCs to adopt MCRS for GFCM priority species in the Mediterranean Sea (GSAs 1–27) specified to each GFCM subregion, if considered relevant and also applicable to recreational fishing, in order to minimize the bycatch of juveniles during fishing operations and with a view to strengthening conservation measures and establishing a level playing field between CPCs. The resolution requests that CPCs call the issue to the attention of relevant national and international authorities so as to improve the collection of data on the size and location of catch by species to allow the SAC to define a uniform basis for an updated MCRS list by GFCM subregion, based on the MCRS already adopted voluntarily (Decision GFCM/37/2013/1).[50] Thus, the SAC is requested to develop a methodology for establishing the best scientific basis for proposing MCRS by species

[47] Recommendation GFCM/44/2021/13 on the mitigation of fisheries impacts for the conservation of seabirds in the Mediterranean Sea.

[48] Recommendation GFCM/35/2011/3 on reducing incidental bycatch of seabirds in fisheries in the GFCM area of application.

[49] Resolution GFCM/44/2021/2 on the definition of a minimum conservation reference size for priority stocks in the Mediterranean Sea.

[50] Decision GFCM/37/2013/1 on guidelines on precautionary conservation measures pending the development and adoption of GFCM multiannual management plans for relevant fisheries at the subregional level in the GFCM area of application.

and GFCM subregion through the compilation and assessment of all available information reported under Decision GFCM/37/2013/1, by GFCM subregion; any other source of additional information, including, but not limited to, scientific literature, surveys-at-sea and research projects, may be used by the SAC in order to update the existing MCRS list and extend it to all priority stocks in the GFCM area of application.

Conservation of sturgeons in the Black Sea (geographical subarea 29)

Aiming to improve the conservation status of sturgeons (family Acipenseridae), which are classified as critically endangered, endangered or vulnerable by the International Union for Conservation of Nature (IUCN), the GFCM adopted in 2021 a resolution[51] encouraging CPCs to take further action to improve the conservation status of sturgeon species and agree to implement a GFCM pilot project on sturgeons in the Black Sea (see following section on "GFCM research programmes, pilot studies and pilot projects"). Contracting parties and cooperating non-contracting parties should also enhance data reporting information on bycatch rates of sturgeons in line with the technical manual of the GFCM Data Collection Reference Framework (DCRF) (GFCM, 2018). Emphasis should be placed on the reporting of information on the types of fishing gear and methods involved in the bycatch of sturgeons, towards ensuring adequate monitoring and informing a bycatch assessment.

GFCM RESEARCH PROGRAMMES, PILOT STUDIES AND PILOT PROJECTS

The concept of GFCM research programmes was first introduced in 2014 for red coral (*Corallium rubrum*). Since 2018, research programmes have been incorporated, through specific recommendations, into the GFCM workplans for both the Mediterranean and the Black Sea (Table 17). Research programmes share the common aim of improving the scientific basis for the provision of advice on existing and potential management measures through dedicated actions towards increasing the quality and quantity of information on resources and addressing previously identified knowledge gaps and shortcomings in relevant scientific or technical advice (Box 20). Although not the first species to be discussed, rapa whelk (*Rapana venosa*) fisheries in the Black Sea were the subject of the first research programme[52] to be implemented. The research programme, managed by the GFCM through the BlackSea4Fish project (Box 25; FAO, 2020) since 2019, was closely followed by research programmes on European eel[53] and red coral[54] in the Mediterranean, both launched in 2020, on common dolphinfish, launched in 2021, and by the planning of similar initiatives for blue crabs (American blue crab [*Callinectes sapidus*] and blue swimming crab [*Portunus segnis*])[55] in the Mediterranean (launched in 2022) and piked dogfish in the Black Sea. More recently, research programmes have been complemented by pilot studies and projects. Pilot studies and projects rest on similar principles, i.e. conducting scientific data collection and analysis on specific themes, fisheries or species, but have a more limited geographical and temporal scope. Four GFCM pilot studies are currently under implementation or underway on selectivity in the Strait of Sicily, bamboo coral (*Isidella elongata*) in the Adriatic Sea, cetacean bycatch in the Black Sea and sturgeon in the Black Sea.

In all cases, the core principle is to take full advantage of ongoing research at the country level by providing experts with a regional platform for coordination, knowledge exchange and capacity building enriched by new activities developed based on common methodologies. The data collected through these initiatives are generally aimed at providing the scientific basis for determining the most appropriate management measures for selected fisheries.

This chapter reports on the advances made on previously introduced (FAO, 2020a) research programmes and actions, while new ones are described in more detail.

[51] Resolution GFCM/44/2021/5 on the mitigation of fisheries impacts for the conservation of sturgeons in the Black Sea (geographical subarea 29).

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

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

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

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

Rapa whelk in the Black Sea (geographical subarea 29)

Rapa whelk is an invasive species originating from the western Pacific that was first observed in the Black Sea in 1947. Since then, the population of this invasive snail 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 in 2018 by Recommendation GFCM/42/2018/9[56] and launched in 2019, under the coordination of the BlackSea4Fish project (Box 25; FAO, 2020). Detailed information on the research programme is provided in *The State of Mediterranean and Black Sea Fisheries 2020* (FAO, 2020a), but it is still ongoing with a proposal to extend it to 2023. The most notable activity under this research programme has been the design and implementation of a scientific beam trawl survey for rapa whelk, which has been carried out twice per year since 2020 (Table 19). The aim of this survey is to collect information on the population at sea of rapa whelk to better understand its biological characteristics, as well as the density and spatial distribution of this resource, including in terms of individual size. It is a good example of a scientific survey carried out using a standardized protocol, providing essential data to be included in the assessment of rapa whelk at the scale of GSA 29. More recently, the research programme has also engaged in stakeholder consultations at the country level (in Bulgaria, Romania and Türkiye) with the aim of performing an appraisal of existing and potential future management measures that takes into account stakeholder views (Chapter 6, Box 18). Work currently being planned foresees a socioeconomic study of rapa whelk fisheries (Chapter 3, Box 11). All the information collected within this research programme will be instrumental in addressing the requirements of Recommendation GFCM/42/2018/9, thus providing the WGBS with the appropriate tools to propose elements of a future long-term multiannual management plan.

TABLE 19. Number of survey hauls conducted per season by country involved in the rapa whelk scientific beam trawl survey

Countries	Autumn 2020	Spring 2021	Autumn 2021	Spring 2022
Bulgaria	53	53	53	53
Georgia	23	23	–	–
Romania	51	51	51	51
Eastern Türkiye	84	84	84	84
Western Türkiye	83	83	83	83
Ukraine	53	53	53	–

European eel in the Mediterranean Sea

On the basis of the provisions of Recommendation GFCM/42/2018/1[57] and the discussions held in 2018 and 2019 by the Working Group on the Management of European Eel, the research programme on European eel was launched in 2020 following the concept note developed in 2018 (FAO, 2020a). It was carried out as a concerted action, joining the forces of nine partners conducting research activities, including research institutes and universities and relevant administrations of the nine countries that had expressed interest (Algeria, Albania, Egypt, France, Greece, Italy, Spain, Tunisia and Türkiye), and was managed by the GFCM Secretariat, with the help of an advisory board. The main aim of the research programme was to 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 on European eel was completed in June 2022; more information on the outcomes of this research programme is provided in Box 20 as an example of the full cycle of a GFCM research programme and how it feeds into management.

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

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

Red coral in the Mediterranean Sea

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 to the SAC's ability to provide further advice on the status of red coral populations and on the management of its unique fishery. The final concept note was approved by the SAC in 2019, and the research programme launched in 2020. The research programme consists of five main actions, coordinated by the GFCM Secretariat. It is still ongoing and currently joins the forces of researchers and national administrations from Algeria, Croatia, France, Greece, Morocco, Spain and Tunisia, as well as independent experts. The five different actions (surveys-at-sea, certification, genetics, stock assessment and socioeconomics) are addressed at the national level depending on their feasibility and coherence with current national legislation.

Blue crabs in the Mediterranean Sea

Two large non-indigenous crab species, the American blue crab and the blue swimming crab – known collectively as blue crabs – have been present in the Mediterranean since at least the first half of the twentieth century. The two species have arrived via different pathways of introduction: the blue swimming crab most likely entered through the Suez Canal, while the arrival of the American blue crab has been attributed to a variety of possible vectors, including ballast water. The appearance and establishment of both species around the Mediterranean has triggered a similar chain of reactions. Initially, concerns were raised over both their threat to 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 blue crab populations and commercialize catch of the species (e.g. designing tailormade fishing gear and analysing potential internal or external markets) is needed. To this end, Recommendation GFCM/42/2018/7[58] 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 for developing targeted fisheries. As with 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 on blue crabs launched in 2022 features the collaboration of partners from all Mediterranean subregions, particularly from those countries where blue crab fisheries are already developed to various degrees, such as Algeria, Croatia, Cyprus, France, Egypt, Greece, Italy, Morocco, Slovenia, Spain, Tunisia and Türkiye. In this first phase, a coordinator has been recruited and prospective work is being organized among partners.

Common dolphinfish in the Mediterranean Sea

Common dolphinfish is a large, highly migratory pelagic species, distributed globally across tropical and subtropical regions. This species has been fished in the Mediterranean since ancient times by capitalizing on its habit of sheltering beneath floating objects. In the western and central Mediterranean, it has social and economic importance, especially in Italy, Malta, Spain (in the Balearic Islands) and Tunisia, where small-scale fisheries actively target dolphinfish using FADs. Common dolphinfish is also captured by pelagic longlines as bycatch and is highly valued by recreational fishers. Scientific evidence suggests that the population of common dolphinfish in the Mediterranean can be considered as a single stock whose fisheries are shared by several coastal countries. This situation calls for coordinated efforts in dolphinfish population assessments and fisheries management.

The provisions of Recommendation GFCM/43/2019/1[59] include the development of a research programme to enhance understanding of the stock's status and explore ways to strengthen its sustainability. The research programme builds on previous efforts carried out in Italy, Malta, Spain and Tunisia and aims at creating the scientific basis for a region-wide management plan to maintain the fishery at sustainable levels for both the species and the sector. The research programme is designed to address the

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

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

above-mentioned objectives through four work packages (WPs), as follows:

- Work Package 1 on "Stock assessment" seeks to improve fisheries data, particularly records of effort, and urges continued <development of the current assessment model.
- Work Package 2 on the "Assessment of the impacts of FADs" aims to compile the relevant information on the description and potential impacts (both biological and environmental) of FADs in the region and complete a socioeconomic analysis of the fishery.
- Work Package 3 on "Potential management scenarios" focuses on the qualitative and quantitative analysis of possible management measures, assessing their feasibility and effectiveness.
- Work Package 4 is a "Transversal work package on coordination, networking and capacity building" and foresees the continuation and strengthening of this network of experts using current technologies to ensure speedy and accurate exchanges of information and internal discussions, as well as the organization of meetings as deemed necessary. Capacity-building activities are also envisaged to expand the use of methods to assess the stock of common dolphinfish and potential management scenarios.

The research programme started in 2021, with relevant outcomes already available for all the work packages, and it is intended to conclude at the end of 2023.

Piked dogfish in the Black Sea (geographical subarea 29)

In response to Recommendation GFCM/44/2021/10,[60] a concept note was developed outlining the main actions to be included in the requested research programme aiming to collect data and information on piked dogfish in the Black Sea. This programme had the ultimate objective of providing the scientific basis for the development of future effective longterm management measures towards sustainable fisheries for this species. The research programme is designed to address the above-mentioned objectives through six WPs, as follows:

- Work Package 1 on "Stakeholder engagement" confirms that the active engagement of fishers, other stakeholders and the general public with piked dogfish in the Black Sea is urgently needed towards fulfilling the requirements of a participatory approach to fisheries management as set in Recommendation GFCM/44/2021/10.[48] Thus, WP 1 aims to: i) create a network of scientific experts and key stakeholders from each participating country to ensure cross-border and long-lasting scientific collaboration; ii) address awarenessraising needs through targeted actions in support of other WPs (e.g. for fishers to facilitate increased collaboration in order to decrease post-release mortality) and for the general public; iii) explore fisher knowledge through local ecological knowledge studies to gather information on bycatch, distribution, seasonality and release mortality, among other aspects of the fishery, and to feed into other WPs; and iv) disseminate objectives, activities and results of the research programme.
- Work Package 2 on "Bycatch" estimates bycatch rates with the objective of quantifying incidental catch rates in the piked dogfish commercial fishery and identifying spatiotemporal bycatch hotspots, in order to obtain accurate and comprehensive bycatch ratios across the Black Sea basin by type of gear and enable detailed maps to show where and when bycatch events are concentrated. This WP has the ultimate aim of identifying technical mitigation strategies to reduce and, if possible, eliminate bycatch of piked dogfish in the Black Sea.
- Work Package 3 on "Biological data collection" contributes to filling major data gaps in knowledge on the biological parameters of the current piked dogfish population in the Black Sea. The main objectives of this WP are to increase the quantity and quality of data on the life-history traits of piked dogfish in the Black Sea, including on habitat preference by sex and on ageing, to be utilized in future stock assessments and in the formulation of future management strategies.
- Work Package 4 on "Spatial dynamics of piked dogfish in the Black Sea" aims to describe the movement patterns associated with environmental parameters towards understanding the spatial ecology and habitat use of piked dogfish by utilizing

[60] Recommendation GFCM/44/2021/10 on management measures for the sustainable piked dogfish fisheries in the Black Sea (geographical subarea 29)

tagging techniques and ultimately identifying potential FRAs.
- Work Package 5 on "Targeting piked dogfish fisheries" aims to collect information (on landings, effort and vessel characteristics, among other aspects) on the fishery targeting piked dogfish with longlines in Bulgaria through a census approach and to investigate the socioeconomic conditions of the fishery.
- Work Package 6 on "Post-release mortality" seeks to estimate the post-release mortality of piked dogfish caught with bottom trawls, begininng with a pilot study to determine the most appropriate methodology, before conducting a wider-scale study.

The research programme is foreseen to be launched in 2022 and will be implemented over a period of two years.

Pilot study for the selectivity of bottom trawl fisheries exploiting demersal stocks in the Strait of Sicily (geographical subareas 12–16)

One of the objectives of Recommendation GFCM/44/2021/12[61], adopted in 2021, is to gradually eliminate discards by avoiding and reducing unwanted catch, requesting the SAC to provide advice on the most appropriate technical measures to improve the selectivity of bottom trawlers targeting European hake and deep-water rose shrimp stocks. To this end, in 2021 the forty-fourth session of the GFCM agreed to implement a pilot study on the selectivity of bottom trawl fisheries in the Strait of Sicily structured around the following four objectives:

- Objective 1 is to assess, at the subregional level, the effectiveness towards reducing the impact of bottom trawling on juveniles of experimentally adopting directly implementable selectivity measures in the trawl fishery for deep-water rose shrimp and European hake in the Strait of Sicily, by: i) fitting a 90° turned mesh (T90) panel on the trawl net extension; and ii) inserting two different types of selective grids into the standard net extension.
- Objective 2 is to assess the effectiveness of the proposed selectivity measures compared with commercial nets (i.e. 40 mm square mesh size).
- Objective 3 is to assess the trade-offs of implementing both the sorting grids and the T90 codend, while taking into account differences in fuel consumption between vessels using the different tested devices.
- Objective 4 is to ensure that the spatial coverage and significance of the foreseen results are maximized by planning the pilot study in a manner in line with the selectivity work carried out elsewhere on similar fisheries and technical measures, such as in the western Mediterranean.

The pilot study will possibly be conducted between the spring and autumn periods in 2022–2023. Over a period of three days, three vessels will operate in parallel at the same time and on the same fishing grounds. One vessel will use a commercial trawl net (namely the control net, operating with a 40 mm square mesh size); a second will use a specific sorting grid (depending on the target species); and the third will be rigged with a T90 panel in the codend. The pilot study will be conducted in consultation with relevant stakeholders and with the support of Italian and Tunisian vessels. The results are foreseen to be presented to the SAC in 2023.

Pilot study on the biology, ecology and distribution of bamboo coral in the southern Adriatic Sea (geographical subarea 18)

The bamboo coral *Isidella elongata* is an alcyonacean coral dwelling on soft bottom sediments at depths ranging between 115 and 1 650 m (Chimienti *et al.*, 2019a). This species is considered nearendemic to the Mediterranean Sea (Grasshoff, 1989), and can form extensive aggregations of colonies, called coral gardens or coral forests (FAO, 2009; Chimienti *et al.*, 2019b), mostly found at depths of greater than 500 m (Chimienti *et al.*, 2019a). As such, *Isidella elongata* plays an important ecological role as a habitat former – particularly when a large aggregation of colonies is present – by increasing the threedimensional habitat complexity of the otherwise flat bathyal bottom. This habitat is relevant for its rich associated fauna, including several fish and crustacean species, which use it as a feeding and refuge area. The presence of *Isidella elongata* therefore influences the availability of resources and has important implications for benthopelagic food webs (Maynou and Cartes, 2012; Buhl-Mortensen *et al.*, 2010; Mastrototaro

[61] Recommendation GFCM/44/2021/12 on a multiannual management plan for bottom trawl fisheries exploiting demersal stocks in the Strait of Sicily (geographical subareas 12 to 16), amending Recommendation GFCM/42/2018/5.

et al., 2017; Carbonara *et al.*, 2020). Because of their cooccurrence with species of high commercial value (e.g. giant red shrimp, blue and red shrimp and Norway lobster), *Isidella elongata* populations are affected by bottom-fishing activities across the Mediterranean basin. Trawlers can cause direct physical damage or exert indirect influences by altering hydrodynamic and sedimentary conditions. In addition, its slow growth, recovery rates, recruitment and long lifespan are specific life-history traits that further compromise the resilience of *Isidella elongata* to such perturbations. For this reason, *Isidella elongata* has been listed as "Critically Endangered" on the Red List of Threatened Species by the IUCN. Habitats of *Isidella elongata* have also been recognized as potential vulnerable marine ecosystems (VMEs) by the GFCM. Despite the increasing interest in deepdwelling VMEs, the number of *Isidella elongata* habitats currently known is limited, including in areas such as the Adriatic Sea (including the Otranto channel in the southern Adriatic Sea) and the central–eastern Mediterranean basin. Based on the frequent co-occurence of *Isidella elongata* habitats with several commercial species and considering the lack of detailed information on *Isidella elongata* habitat-associated fauna and anthropogenic impacts, as well as potential bycatch, the forty-fourth session of the GFCM requested a pilot project with the adoption of Resolution GFCM/44/2021/3.[62] This resolution, which sets the terms for a pilot project to underpin the biology and ecology of *Isidella elongata* in the Adriatic Sea and aims to gain insights into the overlap between *Isidella elongata* VMEs and the bottom trawl fishing footprint, should be launched in 2022 with the aim of providing essential elements for defining new FRAs. In addition, the same resolution outlined the technical actions required towards complying with the requirements of Resolution GFCM/43/2019/6,[63] including an ad hoc socioeconomic survey covering the fleets operating in the area. In particular, the pilot project on *Isidella elongata* will be developed through five main WPs as follows over the period 2022–2023:

- Work Package 1 on the "Creation of a network of scientific experts and key stakeholders" establishes a network of scientific experts and key stakeholders towards ensuring cross-border scientific collaboration for the identification of potential VMEs and related potential spatial management measures in the southern Adriatic, including in-country stakeholder consultations in Albania and Italy.
- Work Package 2 on "Remotely operated vehicle (ROV) surveys" carries out ROV surveys to collect data on both the presence and the condition of colonies, at least in non-trawled areas. The newly collected data emerging from the ROV survey will be used to complement and update the analysis performed in WP 3.
- Work Package 3 on "Analysis of available data" collates available data (e.g. MEDITS and ROV data, information from literature) to undertake a spatio-temporal analysis of the presence and distribution of *Isidella elongata* habitats in GSA 18. This task will include a validation of the areas of high probability of *Isidella elongata* presence in GSA 18 emerging from the modeling exercises, as well as the collation, analysis and mapping of all available information on EFH in GSA 18 (e.g. giant red shrimp spawners and recruits, blackmouth catshark [*Galeus melastomus*] spawners and blue and red shrimp spawners). In addition, an investigation will be carried out of the footprint and spatio-temporal evolution of bottom-contact fisheries in GSA 18 using the best available information.
- Work Package 4 on "Age and growth of *Isidella elongata*" foresees analyses of age and growth to better understand the recovery potential and long-term population dynamics of *Isidella elongata* in view of future management.
- Work Package 5 looks "Towards effective spatial management in GSA 18". The activities under this WP aim to discuss and propose potential new FRA(s) in GSA 18 and to present the results to the Subregional Committee for the Adriatic Sea in 2024. Stakeholder consultations are foreseen during all steps, from the planning of certain activities to the consideration and discussion of both preliminary and final results.

[62] Resolution GFCM/44/2021/3 on a roadmap for the establishment of a fisheries restricted area in the southern Adriatic Sea (geographical subarea 18).

[63] 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.

Pilot project to assess cetacean bycatch in Black Sea turbot gillnet fisheries and to test measures for mitigating the incidental catch of cetaceans

Three species of cetaceans – Black Sea common bottlenose dolphin (*Tursiops truncatus ponticus*), Black Sea short-beaked common dolphin (*Delphinus delphis ponticus*) and Black Sea harbour porpoise (*Phocoena phocoena relicta*) – inhabit the Black Sea basin. All Black Sea coastal countries have ratified or acceded to international treaties that stipulate a commitment to protecting biodiversity (e.g. the Convention on Biological Diversity) and endangered marine species through responsible fishing practices (e.g. *Code of Conduct for Responsible Fisheries* [FAO, 1995]). Recommendation GFCM/37/2013/2[64] foresees that CPCs adopt fisheries management measures to study, monitor, prevent, reduce and, to the extent possible, eliminate incidental catch of cetaceans during turbot gillnet fishing operations. Unfortunately, no results exist from systematic regional bycatch observer programmes for Black Sea harbour porpoise. Aerial surveys were carried out in the Black Sea in 2019 under the umbrella of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic Area (ACCOBAMS), but reports indicate that there is generally too little spatially-explicit information on bycatch rates to determine geographical hotspots of incidental catch with any degree of certainty. Nevertheless, the results of this same study suggest higher cetacean bycatch (mainly of harbour porpoises) in the northwestern Black Sea, Bulgaria, central Türkiye and beyond Romanian territorial waters, with turbot gillnet fisheries responsible for the highest rates of cetacean bycatch (see Chapter 4). Furthermore, it is expected that the use of any potentially acceptable bycatch reduction device for cetaceans will come at a cost to fishers and has to be adequately investigated and quantified, with potential trade-offs examined. Therefore, the involvement of fishers in designing and trialling any selective measures under commercial fishing conditions is the key to achieving a holistic understanding of the net positive effects. With these considerations in mind, the GFCM pilot project to assess cetacean bycatch in Black Sea turbot gillnet fisheries and to test measures for mitigating the incidental catch of cetaceans aims to: 1) increase awareness of the need to reduce cetacean bycatch; 2) update the assessment of the level of cetacean bycatch; 3) test mitigation measures to reduce cetacean bycatch; and 4) estimate the effects of such measures on Black Sea turbot gillnet fishing practices while paying particular attention to actively involving commercial fishers. The project will be carried out in Bulgarian, Romanian, Turkish, Georgian and Ukrainian waters and relevant fishing ports of the Black Sea between June 2022 and May 2024 and is structured into four WPs:

- Work Package 1 on "Awareness raising and fisher engagement in bycatch mitigation measures" will inform fishers on: i) the importance, status and sustainability of the turbot gillnet fishery in the Black Sea; ii) the biology and status of the target and bycaught species of the turbot gillnet fishery in the Black Sea; and iii) the need to reduce cetacean interactions in the fishery. In turn, their opinions will be sought on ways to minimize these interactions and reduce cetacean bycatch.
- Work Package 2 on "Estimation of spatial and temporal distribution of active fishing effort" has seen questionnaires be developed and rolled out during port visits and via telephone and email communications, gathering information on the length of gillnets (km), number of days they are used per month and times and locations of high incidence of cetacean bycatch per month. The important aim of this WP will be to obtain the real fishing effort exerted by building fishers' trust prior to data collection.
- Work Package 3 on "Commercial tests of porpoise alerting devices" uses these devices to imitate harbour porpoise alarm signals, causing the animals to increase their echolocation activity and improving their ability to detect nets. This testing will be carried out under commercial fishing conditions by using commercial gear presently in use, with and without porpoise alerting devices. Biological data collected will cover the numbers and total weights of cetaceans, turbot, piked dogfish and thornback rays, as catch and separately as bycatch. In addition, damage and labour costs required to repair

[64] 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.

both test end control gear will be recorded and averaged as cost per km gear length.

- Work Package 4 on "Experimental tests of porpoise alerting devices and alternative mitigation measures" will compare the catch and bycatch in control and test nets during the intensive fishing season. All the nets will be 2 km in length and set twice per month with different soak times. Both the biological and economic data described in WP 3 will be collected.

Sturgeon in the Black Sea (geographical subarea 29)

The situation remains extremely critical for several species of sturgeon (family Acipenseridae) present in the Black Sea, while their management is significantly complicated by their peculiar life cycle, and therefore potential mitigation of marine fisheries impacts on these species is long overdue. The need to address the most critical issues related to the marine part of the sturgeon life cycle through the implementation of a pilot project in collaboration with all relevant partners and in line with the conservation needs at the national, regional and international levels according to a set of general terms of reference was reflected by the adoption of Resolution GFCM/44/2021/5.[65] The implementation of a pilot project was requested to better inform potential future management measures to mitigate fisheries impacts, enhancing the conservation of sturgeons in the Black Sea.

The pilot project will be carried out during 2022–2023 to address three main objectives:

- Objective 1 is to collate all available information, including on the biology, ecology and distribution of the species, their interactions with fisheries and existing legislation, from relevant scientific literature, research projects, surveys-at-sea and monitoring programmes in the Black Sea, as well as in consultation with national authorities, with the aim of better informing a future discussion on management measures.
- Objective 2 is to collect information from each Black Sea coastal country on the fishing gear and methods involved in the bycatch of sturgeons, towards ensuring adequate monitoring and better informing an assessment of bycatch.
- Objective 3 is to assess and, where possible, quantify the sources of IUU fishing affecting sturgeons.

The creation of a network of scientists and stakeholders will cut across all three objectives, as will awareness-raising activities for fishers and the general public.

SPATIAL MANAGEMENT MEASURES AND RELATED ACTIVITIES

Acknowledging the importance of marine protected areas (MPAs) *sensu latu* as a tool to support fisheries management (FAO, 2011), the GFCM has been active in promoting the establishment of FRAs within well-delimited areas of the Mediterranean Sea, especially in international waters. In addition, the GFCM has recently been involved in recognizing the role of FRAs as a tool for biodiversity conservation. Such a debate was recently launched at the international level within the context of the Convention on Biological Diversity, which created other effective area-based conservation measures (OECMs) as a tool to acknowledge those areas, at land or at sea, that contribute to the conservation of biodiversity though cannot be identified as MPAs *sensu strictu* (Box 21). In recognizing the importance of science and data to underpin any new fisheries management measure and to assist CPCs in implementing the provisions of Resolution GFCM/43/2019/6,[66] which establishes a direct link between fisheries and the conservation of biodiversity, the GFCM has developed a database on sensitive benthic habitats and species that is expected to play a central role in formulating scientific advice on priority areas for spatial management (Box 22). In addition, a publicly available database on national fisheries closures (seasonal or permanent) was developed, in collaboration with the Mediterranean Protected Areas Network (MedPAN) and the European Topic Centre on Spatial Analysis and Synthesis of the University of Malaga, with the aim of displaying centralized information in one single interactive map of areas afforded protection from fisheries at the national level in CPCs (FAO, 2022e).

[65] Resolution GFCM/44/2021/5 on the mitigation of fisheries impacts for the conservation of sturgeons in the Black Sea (geographical subarea 29).

[66] 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.

Fisheries restricted areas

To date, ten FRAs have been established by the GFCM, including one large deep-water FRA below 1 000 m (Table 20). A FRA can be established to protect marine ecosystems or sensitive habitats from potentially significant adverse impacts and to enhance the productivity of marine living resources, including in the deep sea (Figure 88, Table 20). Spatial fishing restrictions addressing more coastal areas have also been implemented, often in conjunction with temporal ones, and included in multiannual management plans (Table 17). These measures encourage CPCs to establish temporal or permanent FRAs in their territorial waters as a means of favouring the recovery of stocks in overexploitation. The section below describes the most recent decisions related to FRAs.

The eastern Gulf of Lion FRA

In 2009, the GFCM established the eastern Gulf of Lion FRA (3 741 km^2) in GSA 7,[67] where important spawning aggregations of various demersal species (European hake, monkfish and lobsters, among others) are reported to occur. This FRA is located in international waters in the northwestern Mediterranean Sea, between Spain and France, on the eastern part of the continental slope of the Gulf of Lion, and it hosts the Estaque, Grand-Rhône and Petit-Rhône submarine canyons, as well as a small part of Marti Canyon. To protect spawning aggregations of fish, the area is protected from possible increases in fishing pressure: fishing effort on demersal stocks by vessels using towed nets, bottom and midwater longlines or bottom set nets was fixed at 2008 levels. When Recommendation GFCM/33/2009/1 entered into force, concerned CPCs were asked to submit to the GFCM Secretariat their lists of authorized vessels fishing in the area at that time and were required to prohibit new vessels from fishing in the FRA so as not to increase the overall fishing effort. No studies of deep-sea ecosystems in the area were available at the time, but the presence of rare deep-water corals, such as *Lophelia pertusa* and *Madrepora oculata*, was considered possible, given their recorded presence in similar areas in the western part of the Gulf of Lion. In 2021, following thorough consultations with stakeholders, the GFCM decided to strengthen the measures in place in the FRA by creating a permanent closure of 45 km^2 within the existing boundaries of the area,[68] while in the remaining area of the FRA, a temporal closure for vessels targeting demersal stocks using towed nets, bottom and midwater longlines, and bottom set nets was established from 1 November through 30 April each year, in addition to the already existing effort restrictions.

The Jabuka/Pomo Pit FRA

In 2017, the GFCM established the Jabuka/Pomo Pit FRA in the central Adriatic Sea (GSA 17),[69] between Italy and Croatia, where any fishing activities using bottom-set nets, bottom trawls, set longlines or traps, as well as recreational fisheries, are prohibited in the core area (zone A) and temporally prohibited from 1 September through 31 October each year in the adjacent areas (zones B and C). Vessels authorized to fish in zones B and C are subject to different temporal fishing effort restrictions depending on the zone. The entire FRA covers an area of 3 143 km^2 and has been clearly identified as a site with unique physical features influencing water circulation dynamics across the entire Adriatic Sea. As such, it is one of the most important EFH for European hake and other valuable species, such as horned octopus (*Eledonecirrhosa*), blackbellied angler (*Lophius budegassa*) and Norway lobster. The area is also known for the regular presence of cetaceans, sea turtles and seabirds and hosts vulnerable benthic ecosystems. This FRA was the first to be accompanied by a comprehensive scientific monitoring plan (see following section on "Towards better management and monitoring frameworks for FRA"), which has allowed for monitoring of its effectiveness in promoting population recovery. Three years of implementation resulted in higher abundances and densities of the main commercial species (Box 26; FAO, 2020). In 2021, the GFCM declared this FRA permanent, [70] and purse seiners

[67] 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.

[68] Recommendation GFCM/44/2021/5 on the establishment of a fisheries restricted area in the Gulf of Lion (geographicala subarea 7) to protect spawning aggregations and deep-sea sensitive habitats, repealing Recommendation GFCM/33/2009/1.

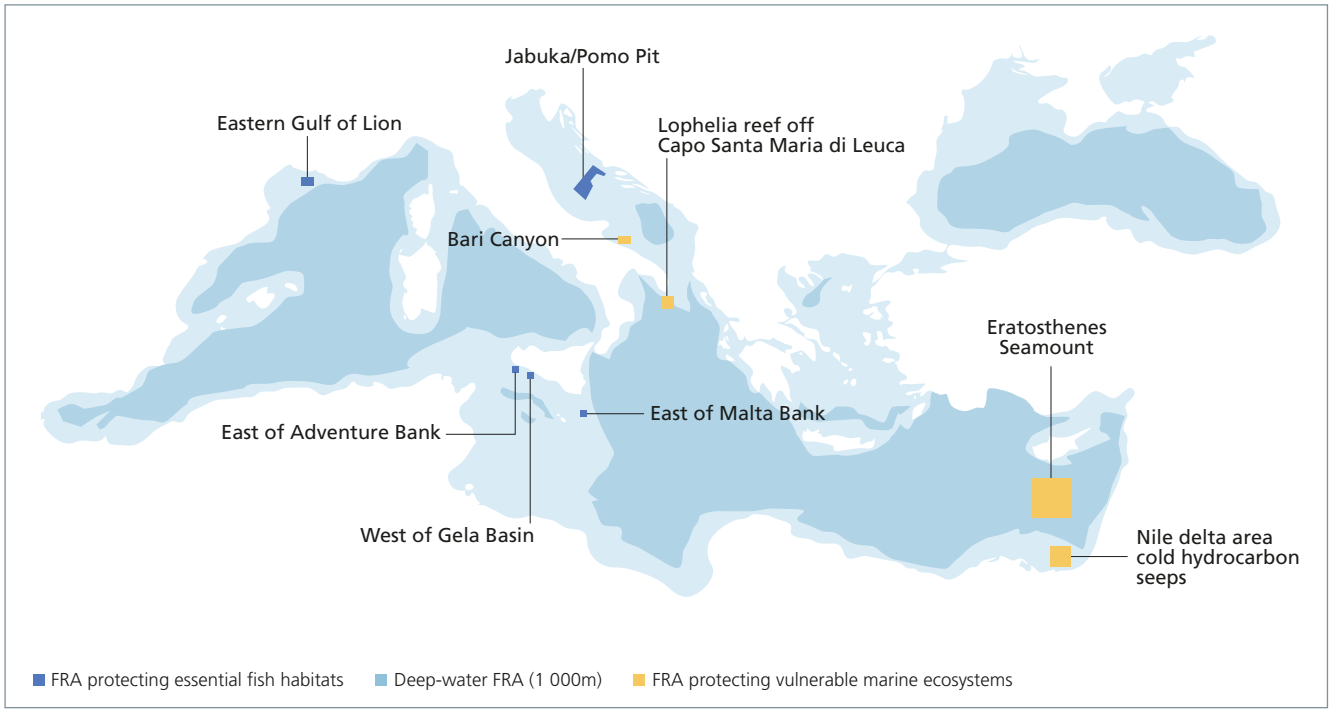
[69] Recommendation GFCM/41/2017/3 on the establishment of a fisheries restricted area in the Jabuka/Pomo Pit in the Adriatic Sea.

[70] Recommendation GFCM/44/2021/2 on the establishment of a fisheries restricted area in the Jabuka/Pomo Pit in the Adriatic Sea (geographical subarea 17), amending Recommendation GFCM/41/2017/3.

TABLE 20. GFCM fisheries restricted areas established from 2005 to 2021

No.	Name	Geographical subarea	Type of restriction	Year	Management objective	Fishing gear
1	Deep-water FRA (> 1 000 m)	Multiple	Year-round closure	2005	To protect unknown fish stocks and deep-sea fish habitats below 1 000 m	Towed dredges and trawl nets
2	Nile Delta area cold hydrocarbon seeps FRA	26	Year-round closure	2006	To protect vulnerable marine ecosystems	Towed dredges and trawl nets
3	Eratosthenes Seamount FRA	25	Year-round closure	2006	To protect vulnerable marine ecosystems	Towed dredges and trawl nets
4	Lophelia reef off Capo Santa Maria di Leuca FRA	19	Year-round closure	2006	To protect vulnerable marine ecosystems	Towed dredges and trawl nets
5	Eastern Gulf of Lion FRA	7	Fishing effort limit, temporal and year-round closures	2009	To protect important essential fish habitats of demersal stocks	Towed nets, bottom and midwater longlines, bottom-set nets
6	East of Adventure Bank FRA	16	Year-round closure	2016	To protect important essential fish habitats of demersal stocks (European hake and deep-water rose shrimp)	Bottom trawls
7	West of Gela Basin FRA	16	Year-round closure	2016	To protect important essential fish habitats of demersal stocks (European hake and deep-water rose shrimp)	Bottom trawls
8	East of Malta Bank FRA	15, 19	Year-round closure	2016	To protect important essential fish habitats of demersal stocks (European hake and deep-water rose shrimp)	Bottom trawls
9	Jabuka/Pomo Pit FRA	17	Year-round and temporal closures	2017	To protect important essential fish habitats of demersal stocks (European hake and Norway lobster) and small pelagic stocks	Bottom-set nets, bottom trawls, set longlines and traps; purse seiners and pelagic trawlers targeting anchovy or sardine
10	Bari Canyon FRA	18	Year-round closure	2021	To protect vulnerable marine ecosystems	All types of fishing gear
ADDITIONAL COASTAL FISHING RESTRICTIONS						
1	Coastal trawl ban (less than 50 m)	Multiple	Year-round closure	2012	To conserve sharks, rays and coastal habitats	Trawl nets
2	Gulf of Gabès (less than 200 m)	14	Temporal closure	2016	To protect important essential fish habitats of demersal stocks	Bottom trawls

FIGURE 88. GFCM fisheries restricted areas



and pelagic trawlers targeting anchovy or sardine were prohibited over the entire area (zones A, B and C) (Table 7.4).

The Bari Canyon FRA

In 2021, a new FRA – the Bari Canyon FRA – was established[71] in the southern Adriatic Sea (GSA 18) off the coast of Bari, Italy to protect vulnerable marine ecosystems in the canyon. The area hosts endangered mega- and macro-benthic organisms, such as cnidarians, as well as EFH, and also serves a nursery for some deep-sea cartilaginous species. To protect these features, an FRA of around 627 km^2 has been established comprising two zones, A and B. In zone A, any professional or recreational fishing activity is prohibited, while in zone B (identified as the buffer zone), fishing activities with towed nets or bottom set nets, as well as recreational fishing, are prohibited. As in other FRAs, to ensure the protection of VMEs, CPCs must call on the attention of relevant authorities to protect these areas from the impacts of any other human activity that may jeopardize the conservation of the features characterizing these particular habitats. This FRA is in force until 31 December 2026.

Towards better management and monitoring frameworks for 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, as well as the importance of proper MCS by relevant CPCs, have recently been underlined at several GFCM meetings, including at the forty-fourth session of the GFCM. On this occasion in particular, out of the need to identify minimum and common standards for the establishment and management of FRAs from conservation, scientific monitoring and MCS points of view, the so-called FRAs toolkit emerged. This toolkit would contribute to levelling the playing field in the region and improving the conservation effectiveness of FRAs.

Regarding scientific monitoring plans, the GFCM Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats agreed, in 2022, on a set of integrated guidelines for the development of scientific monitoring plans for GFCM fisheries restricted areas. These guidelines provide the basic information to design scientific monitoring plans according to the main conservation objective(s) of the FRA, i.e. the protection of EFH (EFH-FRAs) or the protection of VMEs (VME-FRAs). When a particular FRA combines different objectives, a combination of monitoring approaches is expected, taking into account the relative importance of the different objectives and potential trade-offs. Key data that should be collected within such scientific monitoring plans are outlined for each objective.

Scientific monitoring plans for EFH-FRAs, based off the experience of the Jabuka/Pomo Pit FRA (Box 26; FAO, 2020a), should include:

- regular collection of direct observations on the status of priority stocks, with a focus on the stocks mentioned in the objective of the FRA, by means of surveys-at-sea;
- regular collection of fisheries-related data, in accordance with the DCRF, ensuring the collection of comprehensive data on the stocks mentioned in the objective of the FRA;
- comprehensive socioeconomic data collection aimed at assessing the effects of changes in the volume of landings on socioeconomic variables of the fisheries affected by the FRA;
- annual monitoring, at least for GFCM priority species;
- a plan to prepare and provide regular advice on the status of fisheries (including on fisheries resources mentioned in the objective of the FRA and a socioeconomic assessment of the fisheries involved) through the existing expert groups (e.g. the Working Groups for Stock Assessment and the Working Group on Management Strategy Evaluation) and including local ecological knowledge from fishers' direct experiences and perceptions of the effects of the FRA on involved fisheries.

Scientific monitoring plans for VME-FRAs should:

- be designed for the characteristics (biological and ecological) of the benthic habitat subject to the protection measure;
- only employ non-destructive methods, such as those relying on the use of remote tools, such as ROVs or other imaging methods; and
- include monitoring every two to five years, depending on the features of the FRA and

[71] Recommendation GFCM/44/2021/3 on the establishment of a fisheries restricted area in the Bari Canyon in the southern Adriatic Sea (geographical subarea 18).

associated species and the availability of data prior to its establishment.

Regarding MCS measures, a seminar on FRAs, held online in March 2022, allowed for the identification of the challenges and difficulties faced by CPCs in implementing FRAs and for the understanding, based on the direct experiences of CPCs, of FRA management, control and conservation measures and MCS tools, including new technologies. The seminar encouraged progress on the transposition of GFCM recommendations into national legislation, as well as on regular and consistent legal and scientific monitoring, and the experts agreed on the importance of main elements related to the following aspects:

- scientific advice and data made available to the GFCM for the identification of new FRAs;
- delimitation of the FRA, taking into consideration different restriction levels and buffer zones;
- thorough and constructive consultative process for the establishment of the FRA at the national and regional levels, before and after the establishment of the FRA;
- development of MCS and the leveraging of innovative technologies (remote electronic monitoring, including through ancillary tools, drones and satellite imagery, among others);
- data requirements for the management and control of FRAs (FRA authorized vessel lists, infringements, etc.); and
- regular evaluation of the efficiency of the current measures in place in the FRAs at the national and GFCM levels.

CONCLUDING REMARKS

Significant steps forward have been made by the GFCM in terms of managing fisheries resources in its area of application over the last two years, adding to the important efforts of the previous six or so years. Since the last edition of *The State of the Mediterranean and Black Sea Fisheries* (FAO, 2022a), seven existing management plans have been revised. In particular, the multiannual management plan for small pelagic species in the Adriatic Sea seeks to strengthen its output measures by putting all the pieces in place towards the future determination of TAC and quota allocations, while the plan for demersal species in the Adriatic Sea has consolidated input control through the establishment of an effort regime by species and gear. For turbot in the Black Sea, the multiannual management plan, already based on a TAC, is now supported by provisions to establish a CDS in an effort to address IUU fishing issues. Two recommendations were adopted outlining new management measures for European sprat (Recommendation GFCM/44/2021/9) and piked dogfish (Recommendation GFCM/44/2021/10) fisheries in the Black Sea; in the latter case, the need to address the impacts of climate change and environmental factors is also a key element. Importantly, four recommendations addressing the conservation of vulnerable species (elasmobranchs[Recommendation GFCM/44/2021/16], seabirds [Recommendation GFCM/44/2021/13], sea turtles[Recommendation GFCM/44/2021/14] and cetaceans[Recommendation GFCM/44/2021/15]) were approved with the aim of reducing bycatch by identifying mitigation measures and applying spatial management through the establishment of hotspot areas. One crucial aspect common to most new recommendations is an emphasis on the importance of stakeholder involvement and awareness-raising so as to ensure a more holistic and broader uptake of the management measures and provisions set forth, in line with the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea (GFCM 2030 Strategy) (see Box 1).

Although some important stocks are showing tangible signs of improvement (e.g. European hake in the Mediterranean, demersal species in the Adriatic and turbot in the Black Sea; see Chapter 5), further measures are still required to ensure general sustainability. These measures include assessing the effectiveness of multiannual management plans, so as to guarantee that they are truly adaptable, and further implementing spatial measures (notably EFH-FRAs), as highlighted by the five last annual sessions of the GFCM. Simulation tools, such as management strategy evaluation, have and will be useful tools 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. Meanwhile, future work will particularly concentrate on addressing the management of data-limited species. Since technical and data requirements

are high for obtaining the best results from these tools, significant effort is being devoted to both facilitating the enhancement of capabilities across the region (see Box 23) and exploring the use of less data-thirsty, and thus more widely applicable, methodologies.

To continue providing a comprehensive scientific basis for the adoption of long-term management plans for priority species, two new GFCM research programmes are being launched: 1) on piked dogfish in the Black Sea, so as to address identified issues in data quality and quantity for this stock, which is still considered depleted and in need of a recovery plan; and 2) on blue crabs in the Mediterranean to promote coordinated management of the impacts of these non-indigenous species on native commercial species and existing fisheries. Existing research programmes on rapa whelk, red coral and common dolphinfish are continuing, while the research programme on European eel has been finalized, with the collection of a large quantity of information providing concrete guidance for the future management of this ubiquitous and unique species (Box 20) and a second phase on the horizon. The past two years have also seen the emergence of pilot studies and pilot projects, which, in a similar manner to research programmes, aim to collect scientific information on specific issues but have either a narrower spatial or temporal coverage, or both, than their counterparts, as well as more specific management objectives, including, for example: the definition of an FRA in the southern Adriatic through a pilot project on bamboo coral; testing the efficiency and efficacy of different selectivity measures in the Strait of Sicily; and, for the first time, mitigating fisheries impacts on the marine stages of the life cycle of sturgeons in the Black Sea.

The effective implementation of spatial management measures to protect vulnerable or sensitive habitats and ecosystems from significant adverse impacts, as well as to enhance the productivity of EFH, is of prime importance for the GFCM, as expressed in the GFCM 2030 Strategy. In this context, further work is required to extend existing measures in the Mediterranean and the Black Sea, including those geared towards the consolidation of a network of EFH, in order to provide protection that could also help to increase production of species such as European hake. Additional important steps have been taken in the last two years towards this goal. FRAs have come to the fore, proving to be important management tools that can be implemented with and within multiannual management plans; these last two years have seen the establishment of one new FRA and the upgrade of two existing ones, as well as the creation of a toolkit for their scientific monitoring and MCS. Fisheries restricted areas have also been at the centre of international discussions on the identification of future potential OECMs (Box 21), irrespective of their objectives. Data availability, collection and collation are of paramount importance for the GFCM to continue advancing in this direction. The GFCM database on sensitive benthic habitats, with its newly established data call, currently contains around 20 000 records at its disposal for experts to use towards the identification of VMEs and detecting the presence of VME indicator species hotspots. It is considered a primary source for the formulation of objective and uniform advice on priority areas to support possible management measures in the GFCM area of application.

BOX 20. The role of research programmes in determining management priorities: a case study on European eel

The GFCM research programme on European eel (*Anguilla anguilla*) was launched in 2020 as a concerted action achieved by joining forces with ongoing research activities and sharing expertise among nine partner countries. Its objective was to devise a coordinated framework for the collection, collation and analysis of available 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, while fostering a network of scientists to facilitate future work. It was concluded in 2022.

The research programme produced comprehensive scientific and technical outcomes and led to the following main findings:

- Lagoons provide the main habitat for European eel and related fisheries in the Mediterranean.
- Recruitment, documented at 80 sites across the Mediterranean, shows a decreasing trend and was found to be currently at the lowest levels recorded.
- Fishing effort levels were deemed currently unquantifiable.
- Average catch over the past five years accounted for one third of the catch over the entire eel distribution range, while the role of recreational fisheries was found to be uncertain and likely greater than documented.
- Current temporal closures are not always aligned with effective migration periods.

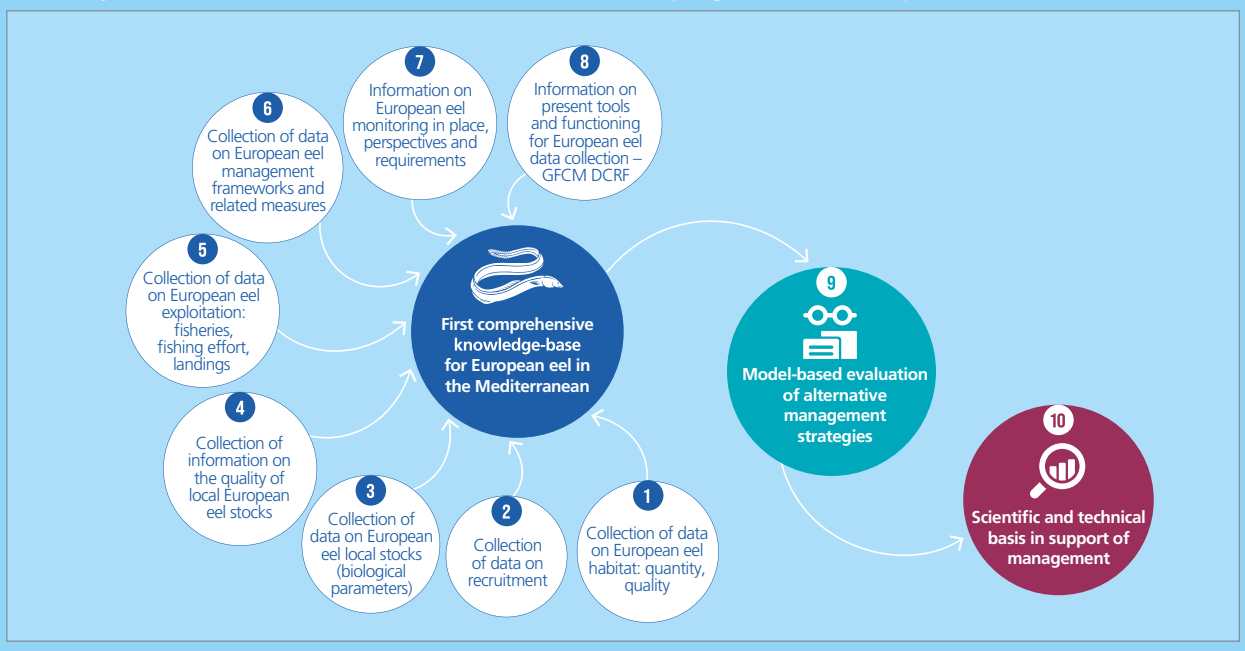
A knowledge base towards informing European eel management in the Mediterranean was generated, and future requirements for the conservation of European eel were identified, including the establishment of habitat enhancement programmes and a common methodology for data collection, involving not only regular standardized monitoring, but also incorporating fisher knowledge to better inform future assessments and management strategy evaluations. This approach will provide better information for implementing coordinated management.

The research programme concluded that further measures were needed, and its scientific advice was to implement, in all countries across the entire distribution range of European eel:

1. immediate actions targeting habitat-related measures; and
2. fishery closure scenarios, acknowledging the importance of considering their impacts on fisher livelihoods. Two potential alternatives were proposed for a suggested three-year period before their re-evaluation:
   i. a pilot phase of zero catch, plus a recruitment assessment over one season; or
   ii. closure of the silver eel fishery, plus a total ban on both recreational and glass eel fisheries, with a recruitment assessment over one season.

   Both alternatives rest on the common conditions of an accompanying compensation scheme for fishers and other persons involved in the value chain, the involvement of fishers in scientific monitoring and a socioeconomic study conducted in parallel.

Summary of the aims and outcomes of the GFCM research programme on European eel



BOX 21. Other effective area-based conservation measures

In 2010, the Parties to the Convention on Biological Diversity (CBD) officially recognized the role of area-based management in biodiversity conservation through the adoption of Aichi Biodiversity Target 11. Target 11 recognizes the role of area-based conservation in protecting marine biodiversity and calls for 10 percent of coastal and marine areas to be conserved under protected areas by 2020. In the Mediterranean, this level was achieved with just under 10 percent covered by marine protected areas (MPAs), although effectively managed MPAs accounted for just over 1 percent.[1] More recently, the 30 by 30 initiative to designate 30 percent of the Earth's land and ocean area as protected areas by 2030 is being discussed in the context of ongoing negotiations towards achieving the Post-2020 Global Biodiversity Framework and has already been adopted as a target by some countries.

An other effective area-based conservation measure (OECM) is "a geographically defined area other than a protected area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the *in situ* conservation of biodiversity, with associated ecosystem functions and services and, where applicable, cultural, spiritual, socioeconomic, and other locally relevant values".[2] The concept opens the door to an additional type of managed area for the benefit of biodiversity alongside MPAs.

In February 2021, the FAO Committee on Fisheries (COFI) noted the relevance of OECMs towards achieving a number of United Nations Sustainable Development Goals and global biodiversity targets and requested that FAO produce and disseminate practical guidelines to support Members in their identification and implementation. In response to COFI's request, the FAO Fisheries and Aquaculture Division launched the development of such guidelines with the aims of explaining the role of OECMs in mainstreaming biodiversity and providing a step-by-step guide to undertaking an OECM assessment of area-based management tools used in the fisheries sector.

Within this framework, FAO and the GFCM organized an Expert Meeting on Fisheries-Related Other Effective Area-Based Conservation Measures in the Mediterranean in 2022. The main objective of this meeting was to promote the identification of fisheries-related OECMs in the Mediterranean, along with providing technical inputs to prepare and test FAO's practical guidelines for the establishment and management of OECMs in the fisheries sector. A set of simplified CBD criteria for OECMs was applied to the identified case studies – including GFCM fisheries restricted areas (FRAs) and fisheries-related measures. Three FRAs (the Jabuka/Pomo Pit in the Adriatic Sea, the East of Adventure Bank and the West of Gela Basin in the Strait of Sicily) were found to be particularly good candidates for OECMs, in view of their conservation objectives and current management and monitoring frameworks. These FRAs, together with the 1 000 m deep-water FRA, were then assessed in more detail as candidates for potential OECMs during relevant GFCM expert meetings and subregional committees. Through these steps, the GFCM has contributed to promoting the concept of OECMs and their possible application at the Mediterranean level. Future actions for assessing given national areas, based on the full set of CBD criteria and the designation of an OECM, remain a prerogative of the relevant country, while discussions on assessments and potential proposals for multinational or international OECMs in the region are expected to continue within the context of the GFCM.

[1] **Gomei, M., Abdulla, A., Schröder, C., Yadav, S., Sánchez, A., Rodríguez, D. & Abdul Malak, D.** 2019. *Towards 2020: how Mediterranean countries are performing to protect their sea*. Rome, WWF.

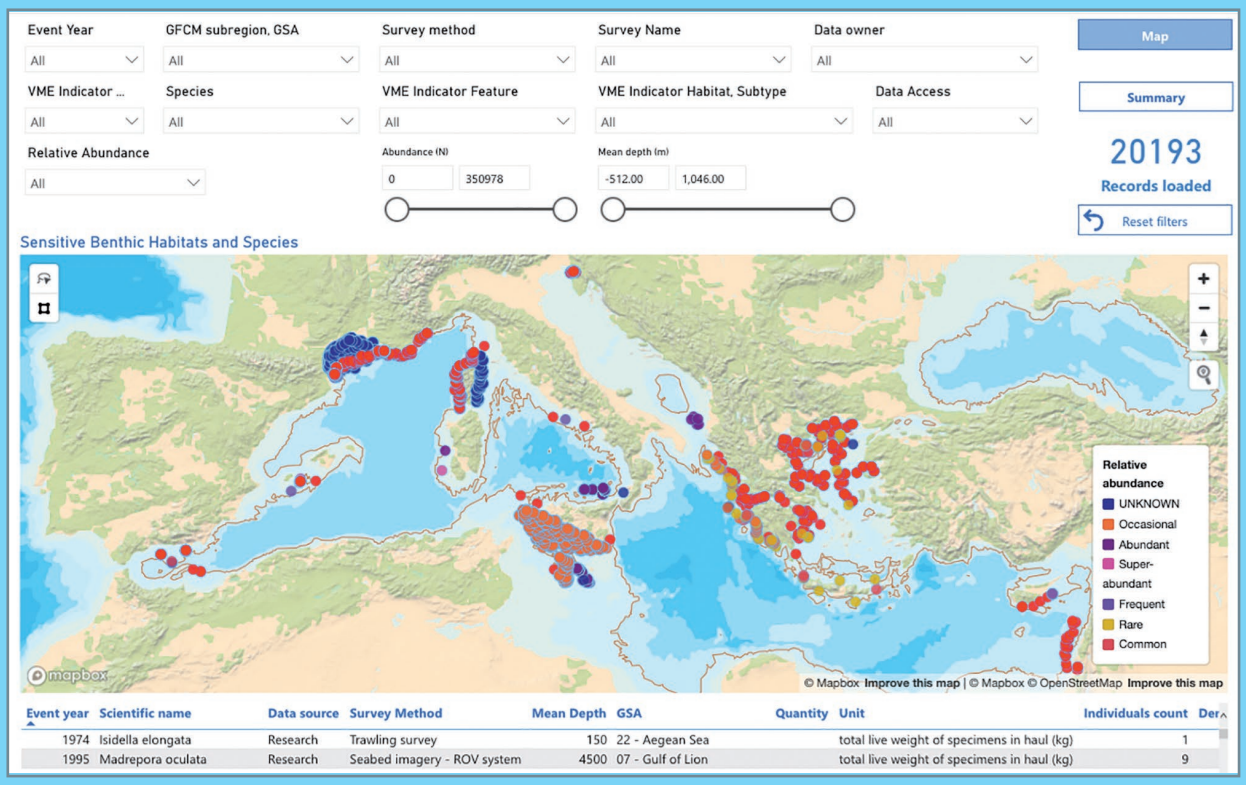
[2] **CBD (Convention on Biodiversity).** 2018. *14/8 – Protected areas and other effective area-based conservation measure*. Conference of the Parties to the Convention on Biological Diversity, Fourteenth meeting, Sharm El-Sheikh, Egypt, 17–29 November 2018. www.cbd.int/doc/decisions/cop-14/cop-14-dec-08-en.pdf

BOX 22. GFCM database on sensitive benthic habitats and species

The GFCM database on 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 essential fish habitats. The development of the database represents one of the actions taken by the GFCM towards improving the management of deep-sea fisheries and preventing potential adverse impacts on vunerable marine ecosystems (VMEs). The database was conceived of as an online platform to showcase information on the distribution of VME indicator taxa, habitats and features in the Mediterranean Sea and to facilitate data analysis in support of spatial management. In 2022, the Working Group on Vulnerable Marine Ecosystems and Essential Fish Habitats and the Scientific Advisory Committee on Fisheries agreed that the GFCM database on sensitive benthic habitats and species would comprise a primary source for the formulation of objective and uniform advice on priority areas for possible management measures in the GFCM area of application. The database is hosted in a password-protected environment where data consultation dashboards and data analysis tools are provided to all experts participating in the GFCM advisory process.

A specific data call for VME indicators addressed to GFCM contracting parties and cooperating non-contracting parties, as well as independent experts and other organizations has been programmed: it was issued for the first time in January 2022 and will be repeated every year in order to keep the database regularly updated. At present, the database includes around 20 000 records on the distribution of more than ten benthic species that may form VMEs (e.g. *Madrepora oculata*, *Funiculina quadrangularis*, *Isidella elongata*) gathered through different types of surveys (e.g. remotely operated vehicles, fishery-independent surveys) across different Mediterranean subregions.

Main dashboard of the GFCM database on sensitive benthic habitats and species



Box 23. The MedSea4Fish capacity development programme

MedSea4Fish was unveiled in 2022 as an ambitious long-term programme serving as a blueprint for more sustainable fisheries in the Mediterranean Sea.

The goal of MedSea4Fish is to transform Mediterranean fisheries through capacity development. It plans to better equip and enhance skills of GFCM countries, as well as spur actions at the national, subregional and regional levels so that the GFCM and its partners can continue turning the corner on overexploitation.

MedSea4Fish capitalizes on lessons learned by the GFCM over the last decade and from the BlackSea4Fish project[1] and is guided by a number of GFCM instruments and frameworks, including GFCM binding decisions, the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Black Sea (GFCM 2030 Strategy),[2] the Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea,[3] the 2017 MedFish4Ever Ministerial Declaration and the GFCM Data Collection Reference Framework.[4]

Promoting an integrated and holistic approach while addressing both regular and strategic activities, MedSea4Fish rests on three main pillars of capacity development at the national level:

- **Monitoring of fisheries and ecosystems** underpins the formulation of comprehensive scientific advice on the status of fisheries, including economic and social aspects, and on the health of the marine environment by supporting the regular collection of relevant data on marine living resources and ecosystems, as well as fisheries activities.
- **Training and capacity building** develops – at the national and subregional levels – the expertise of fishers, fish workers, scientists and representatives of national administrations on the implementation of new fishing technologies, the capacity to collect and analyse data on all aspects of fisheries and the implementation of complex management plans.
- **Infrastructure** supports the upgrading, expansion or new construction of relevant sites and provides the technology and tools to improve national facilities and equipment.

MedSea4Fish is implemented through four subregional projects aligned with the four Mediterranean subregions, accounting for subregional characteristics that call for tailored actions and capitalizing on established mechanisms such as the GFCM subregional technical units and the subregional committees of the Scientific Advisory Committee on Fisheries.

In fulfilling its main objectives, MedSea4Fish liaises with all relevant partners, projects, programmes and initiatives in the Mediterranean region with a view to promoting synergies, avoiding duplication and creating opportunities. The GFCM 2030 Strategy provides the ultimate vision, overall framework and overarching common actions laying the groundwork for the implementation of MedSea4Fish.

[1] **FAO.** 2022. *BlackSea4Fish – Activities and achievements: 2020–2021*. Rome. https://doi.org/10.4060/cc2735en

[2] **FAO.** 2021a. *GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://doi.org/10.4060/cb7562en

[3] **FAO.** 2021b. *The Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://www.fao.org/3/cb7838en/cb7838en.pdf

[4] **GFCM.** 2018. Data Collection Reference Framework (DCRF). Version: 22.2. In: *General Fisheries Commission for the Mediterranean*. Rome. Cited 8 November 2022. http://www.fao.org/gfcm/data/dcrf

References

Bellido, J.M., Santos, M.B., Pennino, M.G., Valeiras, X. & Pierce, G.J. 2011. Fishery discards and bycatch: solutions for an ecosystem approach to fisheries management? *Hydrobiologia*, 670: 317–333.

Borges, L. 2015. The evolution of a discard policy in Europe. *Fish and Fisheries*, 16(3): 534–540.

Borges, T.C., Erzini, K., Bentes, L., Costa, M.E., Gonçalves, J.M.S., Lino, P.G., Pais, C. & Ribeiro, J. 2008. Bycatch and discarding practices in five Algarve (southern Portugal) métiers. *Journal of Applied Ichthyology*, 17(3): 104–114.

Buhl-Mortensen, L., Vanreusel, A., Gooday, A. J., Levin, L. A., Priede, I. G., Buhl-Mortensen, P., Gheerardyn, H., King, N. J. & Raes, M. (2010). Biological structures as a source of habitat heterogeneity and biodiversity on the deep ocean margins. *Marine Ecology*, 31(1): 21-50.

Caddy, J.F. & Mahon, R. 1995. *Reference points for fisheries management*. FAO Fisheries Technical Paper No. 347. Rome, FAO. https://www.fao.org/3/v8400e/v8400e.pdf

Carbonara, P., Zupa, W., Follesa, M. C., Cau, A., Capezzuto, F., Chimienti, G., D'Onghia, G., et al. 2020. Exploring a deep-sea vulnerable marine ecosystem: *Isidella elongata* (Esper, 1788) species assemblages in the Western and Central Mediterranean. *Deep-Sea Research Part I: Oceanographic Research Papers*, 166: 103406 (online). (Cited 20 April 2021). https://doi.org/10.1016/j.dsr.2020.103406

Carpentieri, P. 2019a. *Monitoring the incidental catch of vulnerable species in Mediterranean and Black Sea fisheries: Methodology for data collection*. FAO Fisheries and Aquaculture Technical Paper No. 640. Rome, FAO. https://www.fao.org/3/ca4991en/ca4991en.pdf

Carpentieri, P. 2019b. *Monitoring discards in Mediterranean and Black Sea fisheries: Methodology for data collection.* FAO Fisheries and Aquaculture Technical Paper No. 639. Rome. https://www.fao.org/3/ca4914en/ca4914en.pdf

Carpentieri, P., Nastasi, A., Sessa, M. & Srour, A., eds. 2021. *Incidental catch of vulnerable species in Mediterranean and Black Sea fisheries: a review.* GFCM Studies and Reviews No. 101. Rome, FAO. https://www.fao.org/3/cb5405en/cb5405en.pdf

CBD (Convention on Biodiversity). 2018. *14/8 – Protected areas and other effective area-based conservation measure*. Conference of the Parties to the Convention on Biological Diversity, Fourteenth meeting Sharm El-Sheikh, Egypt, 17-29 November 2018. www.cbd.int/doc/decisions/cop-14/cop-14-dec-08-en.pdf

Chimienti, G., Bo. M., Taviani, M. & Mastrototaro, F. 2019a. Occurrence and biogeography of Mediterranean cold-water corals. In: C. Orejas & C. Jiménez, eds. *Mediterranean Cold-Water Corals: Past, Present and Future*, pp. 213–243. New York, Springer International Publishing AG.

Chimienti, G., Di Nisio, A., Lanzolla, A.M.L., Andria, G., Tursi, A. & Mastrototaro, F. 2019b. Towards non-invasive methods to assess population structure and biomass in vulnerable sea pen fields. *Sensors*, 19(10): 2255 (online). Cited 20 April 2021. https://doi.org/10.3390/s19102255

Damalas, D. & Vassilopoulou, V. 2013. Slack regulation compliance in the Mediterranean fisheries: a paradigm from the Greek Aegean Sea demersal trawl fishery, modelling discard ogives. *Fisheries Management and Ecology*, 20(1): 21–33.

Eliasen, S., Papadopoulou, N., Vassilopoulou, V. & Cat chpole, T.L. 2014. Socio-economic and institutional incentives influencing fishers' behaviour in relation to fishing practices and discard. *ICES Journal of Marine Science*, 71(5): 1298–1307.

European Market Observatory for Fisheries and Aquaculture Products (EUMOFA). 2019. *Species analyses: 2014–2018 edition*. Luxembourg, Publications Office of the European Union.

European Commission. 2019. *Study of the role of women in fisheries in the Mediterranean and Black Sea – Final report.* Luxembourg, Publications Office of the European Union.

FAO. 2014. *The State of the World Fisheries and Aquaculture 2014*. Rome.

FAO. 2016. *The State of Mediterranean and Black Sea Fisheries 2016*. General Fisheries Commission for the Mediterranean. Rome. https://www.fao.org/3/i5496e/i5496e.pdf

FAO. 2017. *Towards gender-equitable small-scale fisheries governance and development – A handbook. In support of the implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication*. Rome. https://www.fao.org/3/i7419e/i7419e.pdf

FAO. 2018. *The State of Mediterranean and Black Sea Fisheries 2018*. General Fisheries Commission for the Mediterranean. Rome. https://www.fao.org/3/ca2702en/CA2702EN.pdf

FAO. 1995. *Code of Conduct for Responsible Fisheries,* Rome.

FAO. 2009. *International Guidelines for the Management of Deep-sea Fisheries in the High Seas.* Rome. http://www.fao.org/3/i0816t/i0816t00.htm

FAO. 2011. *Fisheries management. 4. Marine protected areas and fisheries.* FAO Technical Guidelines for Responsible Fisheries. No. 4, Suppl. 4. Rome.

FAO. 2020a. *The State of Mediterranean and Black Sea Fisheries 2020*. General Fisheries Commission for the Mediterranean. Rome. https://doi.org/10.4060/cb2429en

FAO. 2020b. GFCM capture production (1970–2020). In: *General Fisheries Commission for the Mediterranean*. Rome. Cited 29 November 2022. http://www.fao.org/gfcm/data/captureproduction

FAO. 2021. *The Regional Plan of Action for Small-Scale Fisheries in the Mediterranean and the Black Sea*. General Fisheries Commission for the Mediterranean. Rome. https://www.fao.org/3/cb7838en/cb7838en.pdf

FAO. 2022a. ASFIS List of Species for Fishery Statistics Purposes. In: *FAO Fisheries and Aquaculture*. Rome. Cited 21 November 2022. www.fao.org/fishery/en/collection/asfis/en

FAO. 2022b. *The State of World Fisheries and Aquaculture 2022. Towards Blue Transformation*. Rome. https://doi.org/10.4060/cc0461en

FAO. 2022c. *Global fish trade*. In: *Food and Agriculture Organization of the United Nations.* Rome. Cited 29 November 2022. https://www.fao.org/fishery/statistics-query/en/trade/trade_value

FAO. 2021. *GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea*. General Fisheries Commission for the Mediterranean. Rome, FAO. https://doi.org/10.4060/cb7562en

GFCM. 2018. Data Collection Reference Framework (DCRF). Version: 22.2. In: *General Fisheries Commission for the Mediterranean*. Rome. Cited 8 November 2022. http://www.fao.org/gfcm/data/dcrf

GFCM. 2019. *Report of the second meeting of the Working Group on Small-Scale Fisheries (WGSSF), Podgorica, Montenegro, 6–7 March 2019*. http://www.fao.org/gfcm/technical-meetings/detail/fr/c/1194915/

GFCM. 2020a. *Fisheries and aquaculture in the Mediterranean and the Black Sea: A preliminary analysis of the impacts of the COVID-19 crisis.* Rome, FAO. https://doi.org/10.4060/ca9090en

GFCM. 2020b. *Fisheries and aquaculture in the Mediterranean and the Black Sea: An updated analysis of the impacts of the COVID-19 crisis*. Rome, FAO. https://doi.org/10.4060/ca9902en

GFCM. 2021. Compendium of GFCM decisions. Cited 27 November 2022. www.fao.org/gfcm/decisions/en

GFCM. 2022. *Report of the third meeting of the Working Group on Small-Scale Fisheries (WGSSF), online, 10 March 2022*. https://www.fao.org/gfcm/technical-meetings/detail/en/c/1504474/

Gil, M.M., Palmer, M., Rosselló, R., Alós, J., Cabanellas-Reboredo, M., Grau, A.M. & Morales-Nin, B. 2018. Mixed-fish commercial categories as a strategy for reducing discards from the small-scale fleet. *Fisheries Research*, 205: 105–114.

Gomei, M., Abdulla, A., Schröder, C., Yadav, S., Sánchez, A., Rodríguez, D. & Abdul Malak, D. 2019. *Towards 2020: how Mediterranean countries are performing to protect their sea*. Rome, WWF.

Grasshoff, M. 1989. The Strait of Gibraltar as a faunistic barrier: the gorgonaceans, pennatulaceans, and antipatharians of the BALGIM cruise (Cnidaria: Anthozoa). *Senckenbergiana Maritima,* 20: 201–223

Mastrototaro, F., Chimienti, G., Acosta, J., Blanco, J., Garcia, S., Rivera, J., & Aguilar, R. 2017. *Isidella elongata* (Cnidaria: Alcyonacea) facies in the western Mediterranean Sea: visual surveys and descriptions of its ecological role. *The European Zoological Journal*, 84(1), 209-225.

Maynou, F., & Cartes, J. E. 2012. Effects of trawling on fish and invertebrates from deep-sea coral facies of Isidella elongata in the western Mediterranean. *Journal of the Marine Biological Association of the United Kingdom*, 92(7): 1501-1507.

Palmer, M., Tolosa, B., Grau, A.M., del Mar Gil, M., Obregón, C. & Morales-Nin, B. 2017. Combining sale records of landings and fishers knowledge for predicting métiers in a small-scale, multi-gear, multispecies fishery. *Fisheries Research*, 195: 59–70.

Pranovi, F., Raicevich, S., Franceschini, G., Torricelli, P. & Giovanardi, O. 2001. Discard analysis and damage to non-target species in the "rapido" trawl fishery. *Marine Biology*, 139(5): 863–875.

Santiago, J.L., Ballesteros, M.A., Chapela, R., Silva, C., Nielsen, K.N., Rangel, M., Erzini, K., *et al.* 2015. Is Europe ready for a results-based approach to fisheries management? The voice of stakeholders. *Marine Policy*, 56: 86–97.

Sardà, F., Coll, M., Heymans, J.J. & Stergiou, K.I. 2015. Overlooked impacts and challenges of the new European discard ban. *Fish and Fisheries*, 16(1): 175–180.

Stergiou, K.I., Moutopoulos, D.K., Soriguer, M.C., Puente, E., Lino, P.G., Zabala, C., Monteiro, P., Errazkin, L.A. & Erzini, K. 2006. Trammel net catch species composition, catch rates and métiers in southern European waters: a multivariate approach. *Fisheries Research*, 79 (1–2): 170–182.

Tsagarakis, K., Palialexis, A. & Vassilopoulou, V. 2014. Mediterranean fishery discards: review of the existing knowledge. *ICES Journal of Marine Science*, 71(5): 1219–1234.

Uhlmann, S.S., van Helmond, A.T.M., Stefánsdóttir, E.K., Sigurðardóttir, S., Haralabous, J., Bellido, J.M., Carbonell, A., *et al.* 2014. Discarded fish in European waters: general patterns and contrasts. *ICES Journal of Marine Science*, 71(5): 1235–1245.

Veiga, P., Pita, C., Rangel, M., Gonçalves, J.M.S., Campos, A., Fernandes, P.G., Sala, A., *et al.* 2016. The EU landing obligation and European small-scale fisheries: What are the odds for success? *Marine Policy*, 64: 64–71.

World Bank. 2012. *Hidden Harvest: The Global Contribution of Capture Fisheries.* Washington, DC, World Bank.

World Bank. 2022a. *Consumer price index (2010 = 100)*. In: *the World Bank – Data*. Washington, DC. Cited 30 November 2022. https://data.worldbank.org/indicator/FP.CPI.TOTL

World Bank. 2022b. Official exchange rate (LCU per US$, period average). In: *the World Bank – Data*. Washington, DC. Cited 30 November 2022. https://data.worldbank.org/indicator/PA.NUS.FCRF

Glossary of terms and definitions[1]

Biomass (B): estimated total weight of a fish stock (fish is used as a collective term to include molluscs, crustaceans and any other aquatic animal that is harvested), or of some defined portion of it. Biomass 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 the fishing mortality rate (F_{MSY}). B_{MSY} is a target BRP.

B_{PA}: precautionary reference point for biomass (B) or spawning stock biomass (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 of the stock falling below the deterministic biomass limit (B_{LIM}) (e.g. 5 percent).

B_0: unfished spawning biomass in equilibrium, which represents the theoretical carrying capacity

$B_{40\%}$: reference point for biomass, representing the spawning stock biomass (SSB) equivalent to 40 percent of the unfished SSB (B_0).

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

- **Target BRPs** correspond to a state of a fishery or resource that is considered desirable. Management action, whether during fishery development or the process of rebuilding a stock, should aim to bring the fishery system to this this level and maintain it there. 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 capacity and will be reflected as an explicit management objective for the fishery (e.g. biomass corresponding to maximum sustainable yield [B_{MSY}] or fishing mortality rate [F_{MSY}]).
- **Threshold reference points (ThRps)** indicate that the state of a fishery or 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 be necessary only 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}).
- **Limit BRPs** indicate the limit beyond which the state of a fishery 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

[1] 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.

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* include a reference point for biomass (B_{LIM}).

Benchmark assessment: review and comprehensive analysis of all available information using the best fishery science to date (i.e. the most up-to-date models and reviewed assumptions) to provide advice on the status of a given stock. In particular, the benchmark process includes revising life-history parameters, characterizing the harvested stock, updating or confirming stock identity, estimating one or more fishery-independent biomass index(es) and making available coherent and comparable sources of fishery data (e.g. landings and length structure). Following a benchmark assessment, all historical data, assumptions, and models are expected to be fixed for three to four years.

Bycatch: part of the catch that is unintentionally captured during a fishing operation in addition to the 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) or non-commercial species, as well as to the incidental catch of endangered, vulnerable or rare species (e.g. sea turtles, elasmobranchs, seabirds, marine mammals).

Deep-sea fisheries (DSF): fisheries operating at great depths. In the Mediterranean Sea, deep-sea fisheries 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 greater than 300 m or on offshore seamounts.

Essential fish habitats (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.

Extended survivor analysis (XSA): stock assessment methodology pertaining to the modelling technique called virtual population analysis (VPA). VPA-type models compute historical fishing mortality rates and stock sizes by age, based on data on catches, natural mortality, and certain assumptions about mortality for the last year and last age group. A VPA essentially reconstructs the history of each cohort, assuming that the observed catches are known without error.

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.

Fish stock or stock unit: term for living resources in the community or population from which catches are taken in a fishery. The use of the term "fish stock" usually implies that the particular population is more or less isolated from other stocks of the same species and hence self-sustaining. It also includes commercial invertebrates and plants.

$F_{0.1}$: 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. It is 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 the fishing mortality rate (F_{MSY}).

F_{MSY}: 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): 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. There are two main types of FRAs: those protecting essential fish habitats (EFH-FRA) and those protecting vulnerable marine ecosystems (VMEs) and sensitive habitats in general (VME-FRA).

GFCM priority species: list of species by subregion considered to be of priority and for which advice should be produced. Priority species have been agreed upon in consultation with experts and managers, based on a combination of available information, socioeconomic importance and conservation concern.

Harvest control rules (HCRs): pre-agreed management guidelines that determine how much fishing can take place based on indicators of stock status. For example, a control rule can specify how fishing mortality (F) should vary as a function of spawning biomass. Control rules are also known as "decision rules".

In overexploitation: status of a fish stock related to fishing mortality (F) that emerges from a comparison of the current fishing mortality and the reference point for F (e.g. F_{MSY}) when current F is greater than the F reference point. In this scenario, the exploitation ratio is greater than 1.

Local ecological knowledge (LEK): 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 experience-based information sourced directly from fishers or stakeholders in general or on a particular subject, ranging from small-scale fisheries to non-indigenous species to climate change and more.

Marine protected area (MPA): 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, including a particular habitat (e.g. a mangrove or a reef) or species or a specific fish populations' life stages (e.g. spawners or juveniles), depending on the degree of use permitted. In MPAs, activities (of a scientific, educational, recreational or extractive nature, including fishing) are strictly regulated and may be prohibited.

Maximum sustainable yield (MSY): 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. It is also referred to sometimes as potential yield.

Minimum conservation reference size (MCRS): minimum size of a fish, mollusc, crustacean or other harvested aquatic animal that can be taken by a fishery while ensuring the health of the stock and allowing the species to breed at least once before being removed from the sea.

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, mackerels nei refers to any and all mackerel species that are not reported elsewhere and are aggregated for reporting purposes.

Non-deprecated stock assessment: currently valid assessment for a 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 no older than three years for small pelagic species and no older than five years for demersal species.

Other effective area-based conservation measure (OECM): geographically defined area, other than a protected area, that is governed and managed in ways that achieve positive and sustained long-term outcomes for the *in situ* conservation of biodiversity, with associated ecosystem functions and services and, where applicable, cultural, spiritual, socioeconomic, and other locally relevant values.

Pescatourism: 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 traditions of local communities.

Qualitative advice: precautionary advice on the status of the stock based on data that are not of high enough quality to allow for the numerical estimation of quantities such as fishing mortality and spawning stock biomass.

Quantitative advice: advice on the status of the stock based on quantitative estimates of fishing mortality (F) and spawning stock biomass (SSB) that can be compared to biological reference points to generate exploitation ratios (e.g. F/FMSY or B/BMSY).

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 on just a temporary basis (FAO, 2009).

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

Spawning stock biomass (SSB): 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.

Statistical catch-at-age methods (SCAA): model using age-structured catch data from a fishery to estimate quantities such as population abundance/biomass and fishing mortality rates, employing likelihood methods. Auxiliary data that are used to obtain reliable estimations include an index of abundance (e.g. survey catch per unit effort or fishery effort). Final year estimates are then used as a starting point for short-term forecasts that provide the basis for determining catch limits or targets.

Sustainable exploitation: status of a fish stock related to fishing mortality (F) that emerges from a comparison of the current fishing mortality and the reference point for F (e.g. FMSY) when current F is equal to or lower than the F reference point. In this scenario, the exploitation ratio is equal to or lower than 1.

Vulnerable marine ecosystem (VME): 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 2022

The 2022 edition of the flagship publication of the GFCM, *The State of Mediterranean and Black Sea Fisheries*, provides an up-to-date overview of fisheries status, trends and governance in the region.

Now in its fourth instalment, the publication updates the findings from previous editions while analysing emerging issues in the fisheries sector, including the effects of management plans. For the first time, thanks to the recent consolidation of data quality indicators, trends in the fisheries sector are also analysed at the regional level. Based on data and information from GFCM contracting parties and cooperating non-contracting parties, *The State of Mediterranean and Black Sea Fisheries 2022* delivers the most comprehensive picture of fisheries in the region to date.

Against the backdrop of the impacts of the COVID-19 pandemic and of renewed strategic commitments, the first two chapters present the characteristics of the Mediterranean and Black Sea fisheries sector, with figures on the fleet and capture fisheries production; chapters three and six showcase the human dimension behind fisheries through socioeconomic data and specific insights on small-scale fisheries, given their relative importance; chapters four and five provide an overview of the status of commercial living resources and of vulnerable species; and chapter seven outlines the measures taken and remaining challenges towards building a sustainable future for fisheries at the subregional and regional levels.

The objective of *The State of Mediterranean and Black Sea Fisheries* is to deliver useful, reliable data to a wide audience as an essential source of information on the fisheries sector in the region and a key tool to support decision-making and monitor progress towards the goals set by the GFCM.

ISBN 978-92-5-137370-5 ISSN 2413-6905

9 789251 373705

CC3370EN/1/12.22