Food and Agriculture Organization of the United Nations

General Fisheries Commission for the Mediterranean

SPECIAL EDITION

The State of Mediterranean and Black Sea Fisheries 2023

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The State of Mediterranean and Black Sea Fisheries

2023

SPECIAL EDITION

Food and Agriculture Organization of the United Nations
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Preparation of this document

he State of Mediterranean and Black Sea Fisheries 2023 – Special edition is the fifth instalment of the report prepared by the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO) on fisheries status, trends and governance in the region. Its first six chapters describe and analyse the current composition of the fishing fleet (Chapter 1), the region's overall capture fisheries production (Chapter 2), the economic performance and socioeconomic characteristics of capture fisheries (Chapter 3), discards in fisheries (Chapter 4), the status of fishery resources (Chapter 5), and, for the first time, aquaculture production in the region (Chapter 6). Finally, Chapter 7 outlines fisheries management measures put in place by the GFCM to support the sustainability of fisheries and the conservation of the marine environment and ecosystems.

This edition arrives just one year after the last issue of *The State of Mediterranean and Black Sea Fisheries* and communicates its findings in a shorter, condensed version similar to the "at a glance" pamphlets that accompanied the release of previous issues, with chapters summarizing the main aspects and messages in just a few pages. It sets the series on a new biennial cycle of odd-numbered years, with the next release scheduled for 2025. This shift will maximize its impact, including by providing regional information in support of *The State of World Fisheries and Aquaculture* and allowing this FAO flagship fisheries publication to feature the most up-to-date data and information available on FAO Major Fishing Area 37 – the Mediterranean and the Black Sea.

Overview

n 2021, the fisheries and aquaculture sector in the Mediterranean and the Black Sea reached a total production of almost 2 million tonnes (1 063 000 tonnes from fisheries, 870 000 tonnes from aquaculture), generating revenues of USD 20.5 billion (USD 7.8 billion from fisheries, USD 12.7 billion from aquaculture) and supporting more than 700 000 jobs (457 500 in fisheries, 243 750 in aquaculture) along the full value chain.

Since doubling between the 1970s and 1980s, total capture fishery production levels have significantly declined, with large fluctuations between years. Recently, revenues from capture fisheries are slightly up since 2020 (+1.3 percent), while employment is slightly down (–5.7 percent) and the fishing fleet has remained quite stable. Aquaculture production, on the other hand, has nearly doubled (+91.3 percent) in the last decade, with revenues also showing a significant increase (+74.5 percent) over the same period.

Türkiye is the largest contributor to both capture fisheries and aquaculture production in the region, followed by Italy and Tunisia for capture fisheries and by Egypt and Greece for aquaculture production. As for species groups, catches are still largely dominated by small pelagic fish – mainly European anchovy in the Black Sea and sardine in the Mediterranean Sea. European hake and sardine landings have shown a continuous declining trend since the 1980s, and Mediterranean horse mackerel has shown a sharp decline since the early 1990s. Catches of deep-water rose shrimp, common cuttlefish and mullets (red mullet and surmullet), meanwhile, show an increasing trend in recent decades. Aquaculture production is dominated by gilthead seabream, European seabass and Mediterranean mussel, which account for 34 percent, 33 percent and 10 percent of total production in Mediterranean and Black Sea countries, respectively.

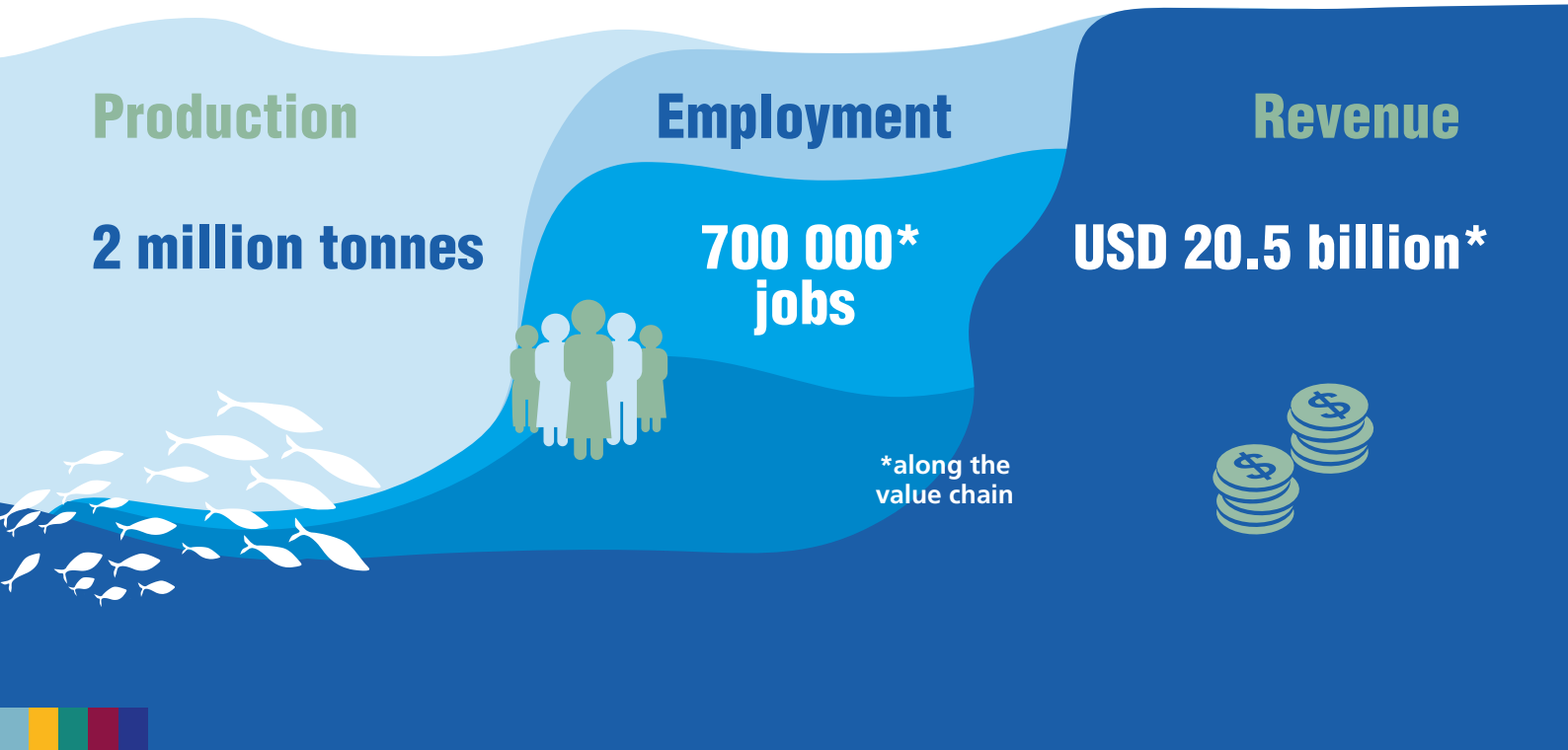
Small-scale vessels continue to make up the vast majority of the fishing fleet (82 percent of the total) and provide more than half of total employment (61 percent). Although they only account for about 15 percent of catches, these vessels bring in nearly 30 percent of total revenue.

The percentage of overexploited fish stocks in the region has fallen from 73 percent in 2020 to 58 percent in 2021, representing the lowest rate observed since the trend in overexploitation was first reversed a decade ago. This improvement is consistent with a continuous reduction in overall fishing pressure, which has fallen by 31 percent since 2012. Although this pressure overall is still at twice the level considered sustainable (F/F_{MSY} = 2.13), the continuous focus placed by the GFCM on expanding management plans and technical and spatial measures is having positive results for key commercial species. Some stocks under management plans show a larger than average reduction in fishing pressure, with notable examples including a 77 percent reduction since 2011 for common sole in the Adriatic Sea, and a 73 percent decrease since 2013 for turbot in the Black Sea. This reduction is leading a number of stocks under management plans to a sustainable level of fishing pressure, though for some of these stocks biomass levels are not yet restored to target values.

The GFCM has continued to use fisheries restricted areas to manage resources and protect sensitive species and vulnerable marine ecosystems, a strategy that has been supported by a growing database of sensitive benthic habitats and species, now with more than 20 000 records. Regional efforts to limit bycatch are growing, also taking into account advice emanating from the design and implementation of discard monitoring programmes.

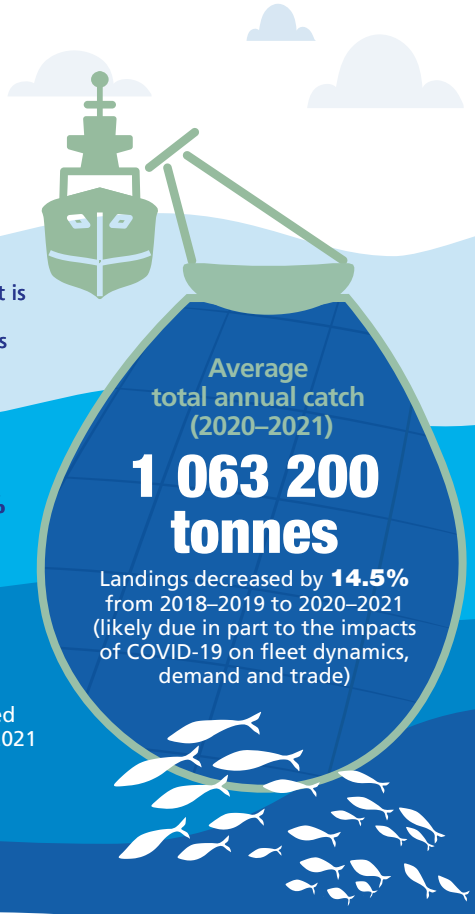
FISHERIES AND AQUACULTURE
IN THE MEDITERRANEAN AND THE BLACK SEA

Together, fisheries and aquaculture make significant contributions to regional food security, livelihoods and economies, and they have a vital role to play in ensuring a sustainable future.



SNAPSHOT OF FISHERIES
IN THE MEDITERRANEAN AND THE BLACK SEA

Despite a reduction in landings and jobs, fisheries make a significant contribution to food production, livelihoods and the economy.



84 200
vessels

87% operate in the Mediterranean Sea and **13%** operate in the Black Sea

82% of the fleet is composed of small-scale vessels

500 000
jobs along the value chain

183 000 jobs are on board vessels

Job numbers decreased by **6%** in 2020–2021

USD 3 billion
annual revenue

USD **7.8 billion** is the estimated total contribution to the regional economy

Revenue increased by **1%** in 2020–2021

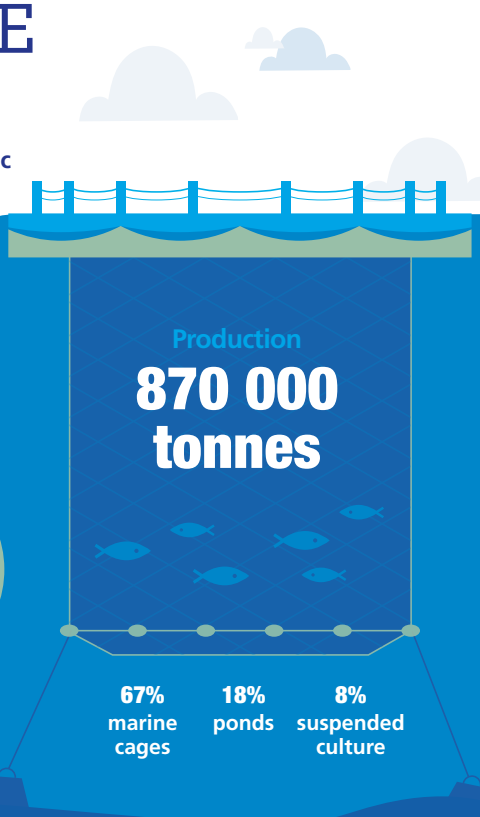
Average total annual catch (2020–2021)

1 063 200 tonnes

Landings decreased by **14.5%** from 2018–2019 to 2020–2021 (likely due in part to the impacts of COVID-19 on fleet dynamics, demand and trade)

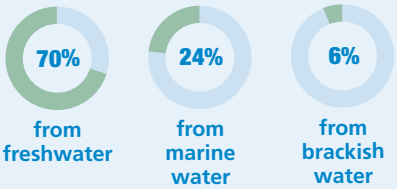
SNAPSHOT OF AQUACULTURE
IN THE MEDITERRANEAN AND THE BLACK SEA

Aquaculture production has been steadily increasing since 2011, and the sector is making an ever-growing contribution to food security, employment and economic development in the region.



Total production in countries bordering the Mediterranean and the Black Sea in 2021

3 299 000 tonnes



Revenue
USD 4.9 billion

Jobs
97 000+
directly employed

17.9%
of jobs held by women

Marine and brackish water aquaculture in the GFCM area of application in 2021

Production

870 000 tonnes

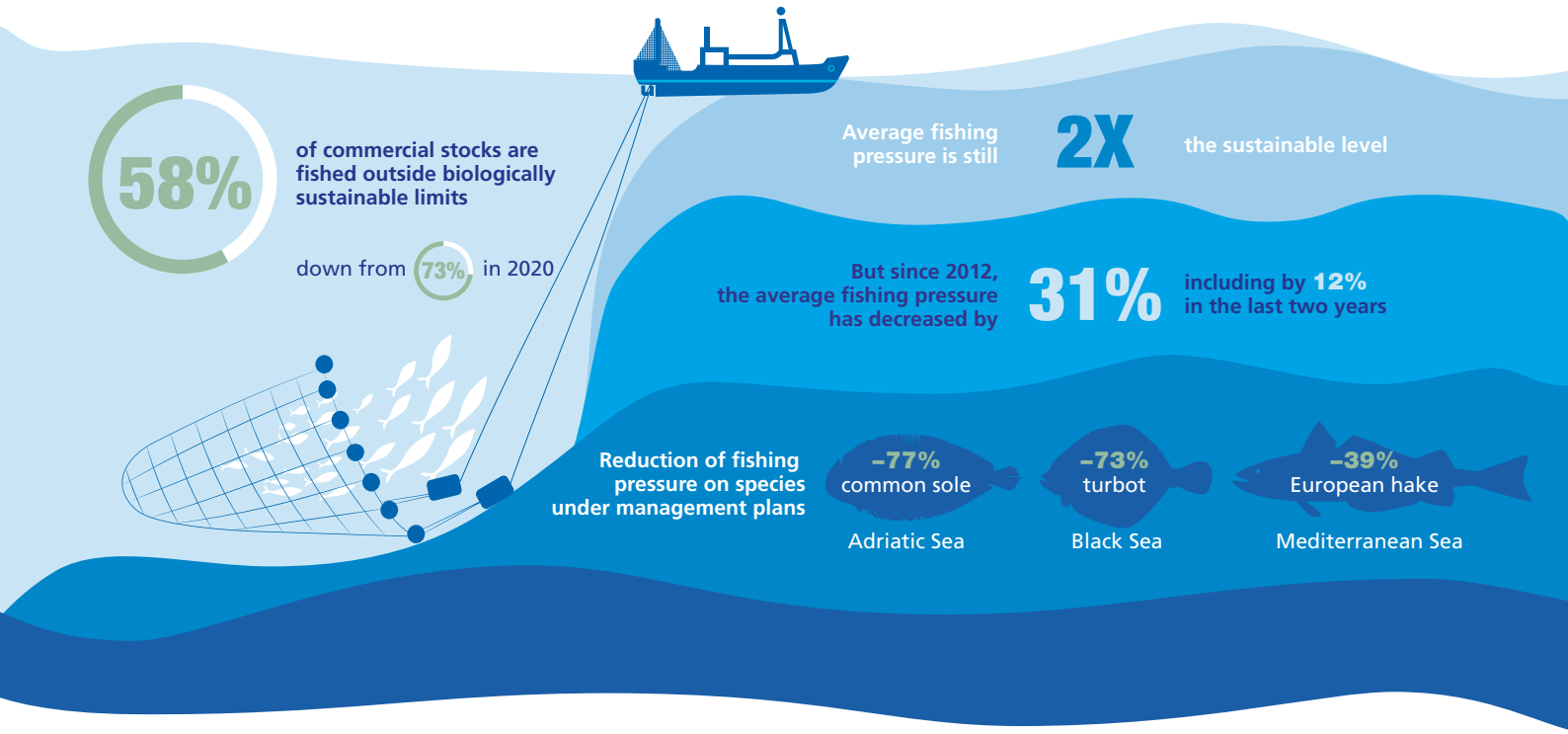
67% marine cages

18% ponds

8% suspended culture

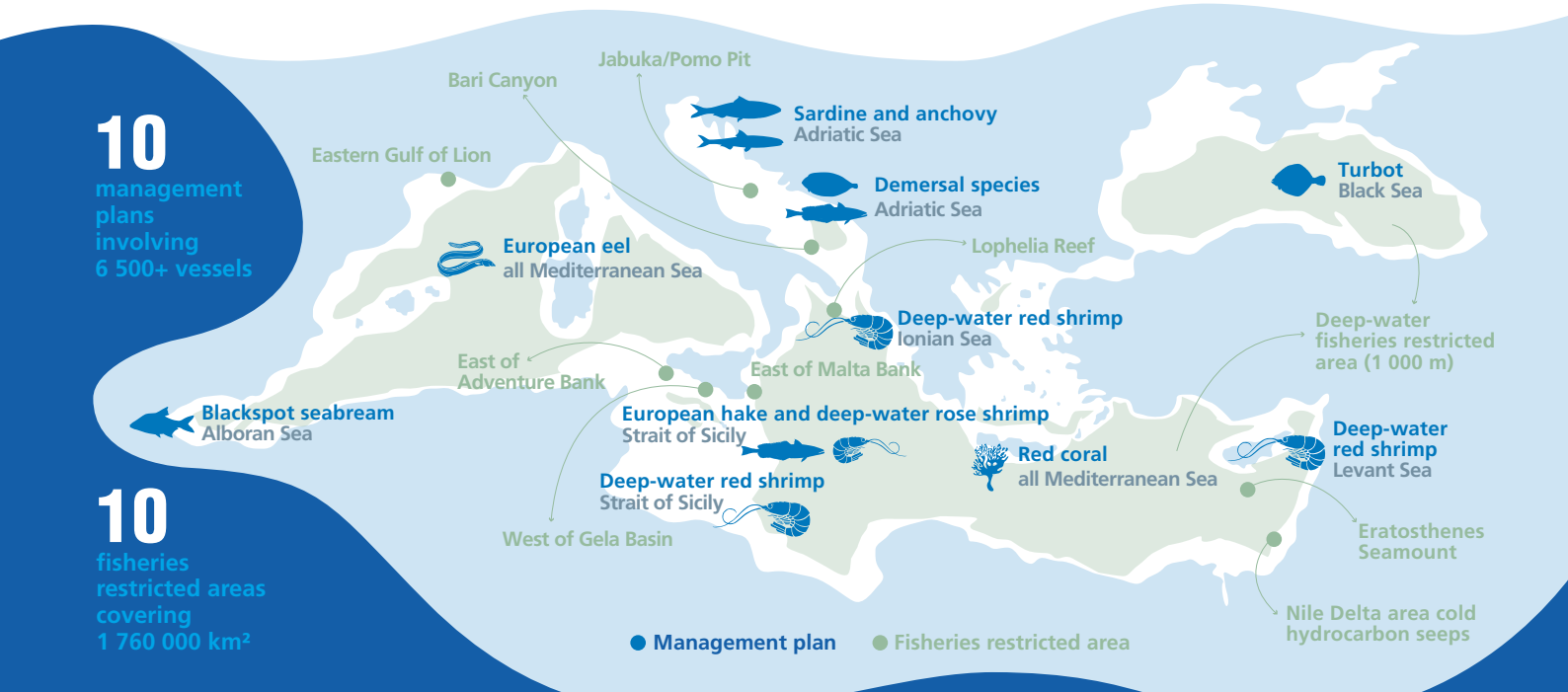
FISHERIES RESOURCES
IN THE MEDITERRANEAN AND THE BLACK SEA

**Overexploitation of stocks has decreased over the past decade.
However, most commercial species are still fished at unsustainable levels.**



FISHERIES MANAGEMENT
IN THE MEDITERRANEAN AND THE BLACK SEA

A regional governance framework is providing tangible results in reducing unsustainable fishing pressure on key species, but it needs to be extended and enhanced to achieve greater sustainability.



HUMAN DIMENSION OF FISHERIES

IN THE MEDITERRANEAN AND THE BLACK SEA

Fisheries are an important source of livelihood for men and women and are embedded in the fabric of coastal communities.
Targeted social support for the sector helps ensure their resilience.

On average, 1 in every 1 000 coastal residents is a fisher

49% OVER THE AGE OF 40 | **52%** OVER THE AGE OF 40

17% UNDER THE AGE OF 25 | **10%** UNDER THE AGE OF 25

2018 → 2020

AGEING WORKFORCE

Non-vessel-based jobs are estimated to employ almost **2.5 times** as many people as those on board vessels, and women play an important role in these jobs

Small-scale fisheries play a vital role, accounting for

of the fishing fleet | of total onboard employment | of total revenue | of total catch

Remuneration of small-scale fishers is half of what industrial fishers earn

The small-scale fisheries sector has a limited profit margin

67% of GFCM countries provide social security benefits to small-scale fishers

50% of GFCM countries provide unemployment benefits, which constitute the fastest growing social protection category

DISCARDS

IN THE MEDITERRANEAN AND THE BLACK SEA

High levels of discards reduce harvesting opportunities and have negative consequences on marine ecosystems. Overall, bottom trawlers remain responsible for the highest discard ratios, although a slight reduction since previous editions of *The State of Mediterranean and Black Sea Fisheries* has been observed.

Discard ratios by subregion

Bottom trawlers

Purse seiners

Set longliners

Small-scale fisheries

Discard ratio < 15 %

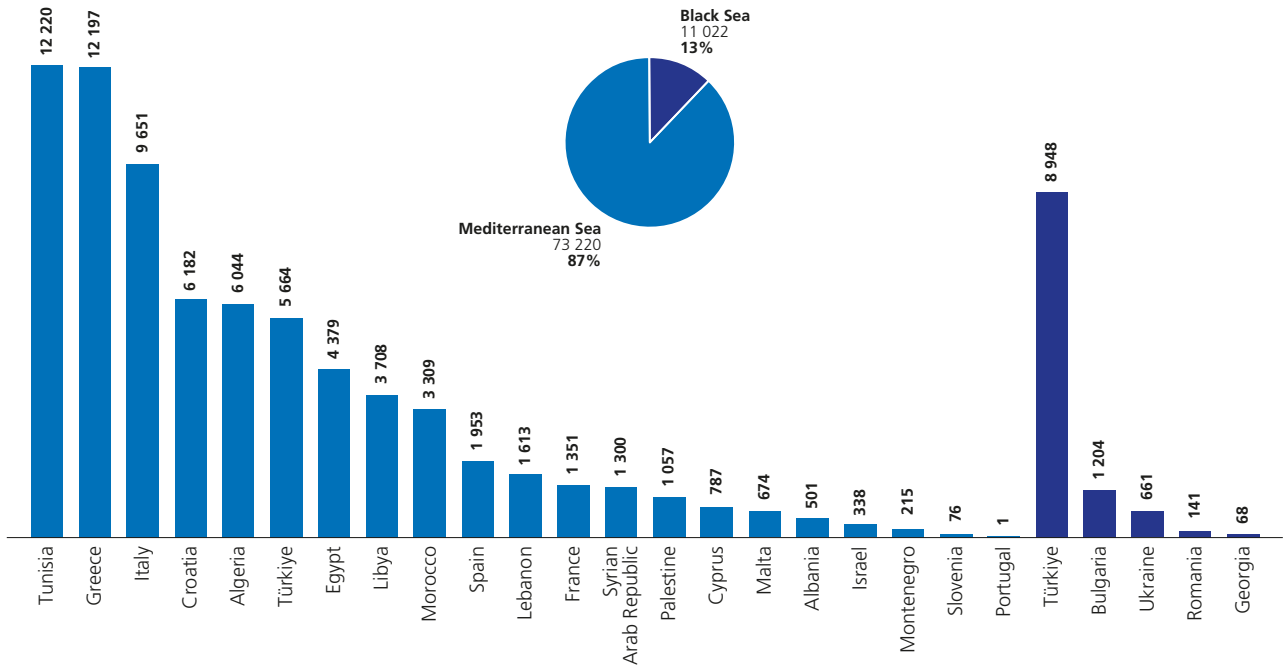
Discard ratio 15–40%

Discard ratio > 40 %

1. Status of the fishing fleet

The operating fishing fleet in 2022 in the GFCM area of application (Mediterranean and Black Sea) totalled 84 242 fishing vessels (87 percent operating in the Mediterranean and 13 percent in the Black Sea), with a total capacity of 867 400 gross tonnage (GT). These figures are similar to those reported in the *The State of Mediterranean and Black Sea Fisheries 2022* (FAO, 2022a), showing a small decrease by 1.2 percent in numbers and a small increase by 3 percent in GT. Four countries (Tunisia, Greece, Italy and Türkiye) account for 58 percent of the total fishing fleet, while 64 percent of the total fishing capacity is represented by five countries (Italy, Türkiye, Tunisia, Egypt and Algeria). The breakdown by GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor is detailed in Figure 1.

FIGURE 1. Number of fishing vessels operating per GFCM contracting party, cooperating non-contracting party, non-contracting party and relevant non-state actor



Notes:
Bosnia and Herzegovina and Monaco are not included, having reported that they had no operating fishing fleet at the time of publication.
The Russian Federation provided no data on its fishing fleet in the GFCM area of application.
Data for the 2022 reference year are displayed, with the following exceptions due to missing transmission to the GFCM: Egypt (2021), Libya (2021), the Syrian Arab Republic (2019) and Ukraine (2020).

FISHING CAPACITY

According to the most up-to-date information reported to the GFCM, the capacity of operating fishing vessels in the Mediterranean and the Black Sea reaches about 867 400 GT and 5 407 000 kilowatts (kW) (Figure 2). Five countries alone account for around 63 percent of the total fishing capacity (in GT) in the GFCM area of application: Türkiye (18 percent), Italy (14 percent), Tunisia[1] (12 percent), Egypt (10 percent) and Algeria (9 percent). Other national fleets of substantial capacity (more than 45 000 GT) are from Greece, Libya and Spain.

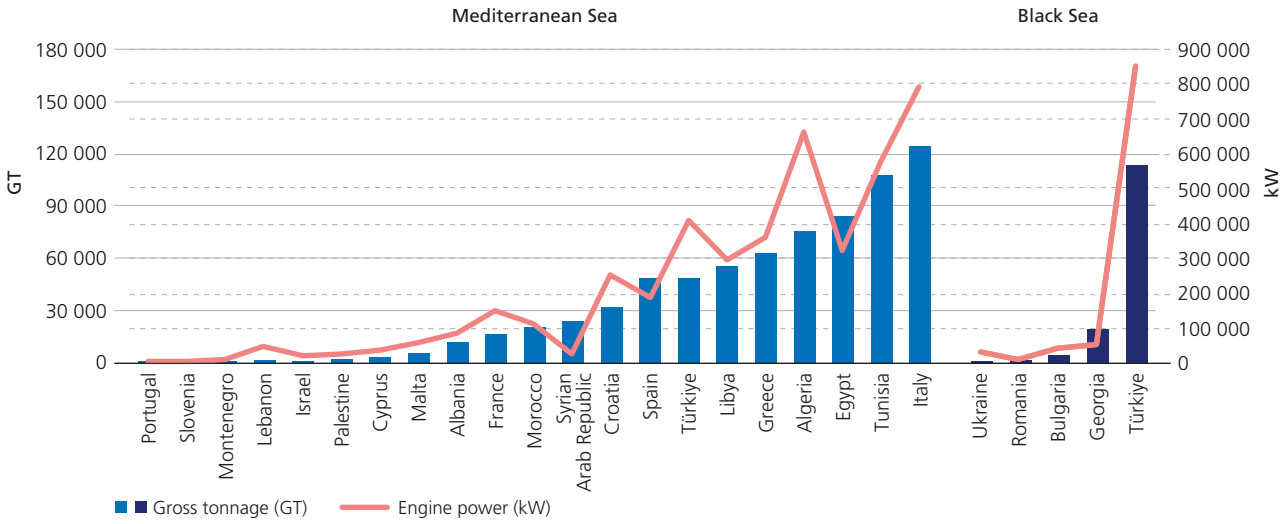
Italy is the highest contributor to the total fishing capacity (in GT) in the Mediterranean Sea (17 percent), followed by Tunisia at 15 percent. Türkiye is the predominant country in the Black Sea (81 percent), with Georgia contributing 14 percent.

[1] As officially communicated by Tunisia, the reported capacity data are for fishing vessels above 5 tonnes (GT) only.

AUTHORIZED FISHING VESSELS IN GFCM PRIORITY FISHERIES AND FISHERIES RESTRICTED AREAS

Nearly 6 600 fishing vessels (8 percent of the total fishing fleet in the GFCM area of application) operate within the context of ten GFCM fishery management plans and three GFCM management measures. The multiannual management plan for sustainable demersal fisheries in the Adriatic Sea accounts for the greatest number of authorized vessels, with around 70 percent of this fleet belonging to Italy. It is important to highlight that 65 percent of the vessels authorized to fish demersal stocks in the Strait of Sicily (geographical subareas [GSAs] 12–16) are also included in the authorized vessel list for deep-water red shrimp fisheries – giant red shrimp (*Aristaeomorpha foliacea*) and blue and red shrimp (*Aristeus antennatus*) – thus bringing the effective number of operating vessels in this area down to just over 1 000. A similar dynamic plays out in the Black Sea, where approximately 100 vessels are involved in more than one of the management plans in place.

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



Notes:
Bosnia and Herzegovina and Monaco are not included, having reported that they had no operating fishing fleet at the time of publication.
The Russian Federation provided no data on its fishing fleet in the GFCM area of application.
Libyan fishing capacity is estimated taking into account fishing fleet information officially transmitted by Libya to the GFCM (via the GFCM Data Collection Reference Framework) and additional information on average capacity by length overall taken from similar national fleets in the region.
Capacity data for the Tunisian fishing fleet are available for fishing vessels above 5 tonnes gross tonnage only.
Data for the 2022 reference year are displayed, with the following exceptions due to missing transmission to the GFCM: Egypt (2021), Libya (2021), the Syrian Arab Republic (2019) and Ukraine (2020).

Across three fisheries restricted areas (FRAs), 154 vessels are authorized to operate, 73 percent of them active in the Jabuka/Pomo Pit (GSA 17) versus 25 percent in the Gulf of Lion (GSA 7) and 2 percent in the Bari Canyon (GSA 18) FRAs. The countries fishing in the Jabuka/Pomo Pit (Italy and Croatia) and the Gulf of Lion (France and Spain) contribute equal parts to the composition of the respective fleets, whereas only the Italian fleet operates in the Bari Canyon FRA.

Detailed information on the number of vessels, overall length (average) and fishing capacity of the different fleets authorized to operate in GFCM priority fisheries and FRAs is shown in Figure 3.

FISHING FLEET SEGMENTS

As shown in Figure 4, "Small-scale vessels" continue to account for around 82 percent of the fishing fleet operating in the Mediterranean and the Black Sea, with 68 100 fishing vessels, followed by "Trawlers and beam trawlers" (around 6 700 vessels, 8 percent), "Purse seiners and pelagic trawlers" (almost 4 300 vessels, 5 percent) and "Other fleet segments" (almost 4 000 vessels, 5 percent).

In terms of percentage, the prevalence of the "Small-scale vessels" fleet segment group is higher in the Black Sea (9 200 vessels, 85 percent) than across the whole GFCM area of application.

In the Mediterranean Sea, the "Small-scale vessels" group leads the fleet composition in all four subregions, especially in the central and eastern Mediterranean, where it represents 85 percent of the operating fleet, at 19 600 and 18 800 vessels, respectively. The "Trawlers and beam trawlers" group ranges from 5 percent in the central Mediterranean (1 270 vessels) to 13 percent in the Adriatic sea (1 338 vessels). Finally, the least represented vessel group in Mediterranean subregions (excluding the aggregated group "Other fleet segments") corresponds to "Purse seiners and pelagic trawlers", which shows a relative peak in the western Mediterranean (12 percent, 1 960 vessels) and contributes particularly low percentages in the central Mediterranean (3 percent, 680 vessels) and the Adriatic Sea (3 percent, 290 vessels).

FIGURE 3. Authorized fishing vessels in GFCM priority fisheries and fisheries restricted areas

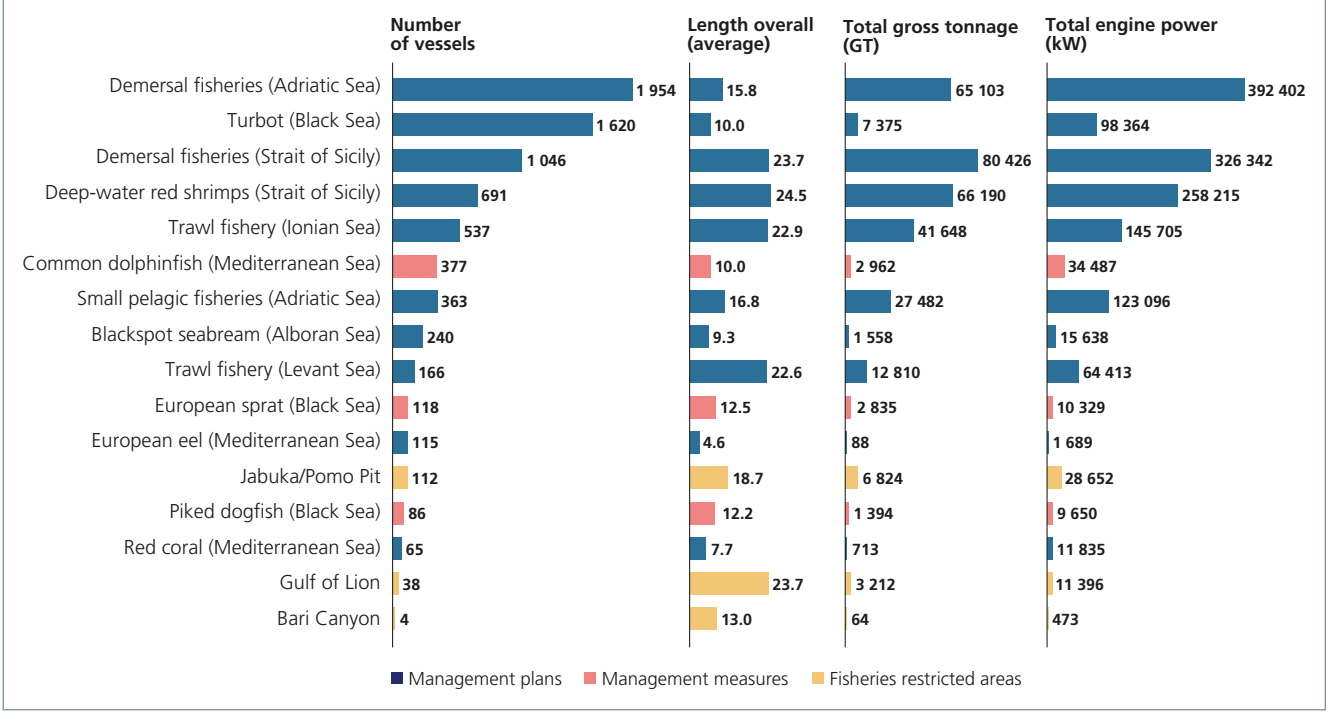
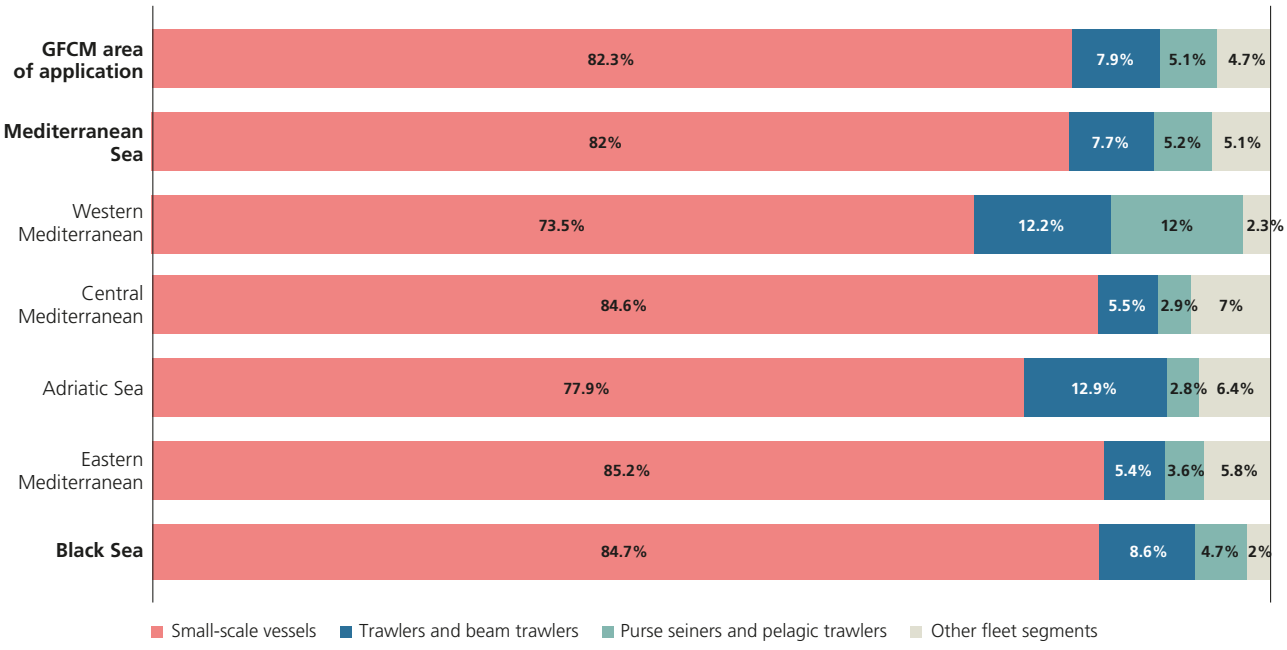


FIGURE 4. Fleet segment composition in the GFCM area of application

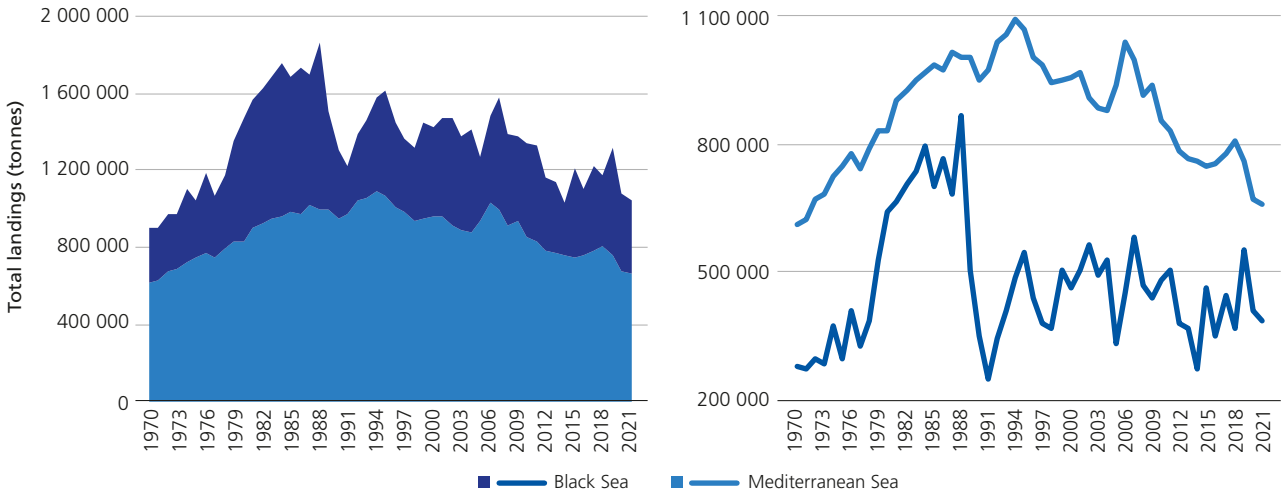


Notes:
Bosnia and Herzegovina and Monaco are not included, having reported that they had no operating fishing fleet at the time of publication.
The Russian Federation provided no data on its fishing fleet in the GFCM area of application, and the Syrian Arab Republic provided no information about its fleet segment composition.

2. Capture fisheries production

Historical trends in fisheries landings in the Mediterranean and the Black Sea have followed a series of ups and downs since 1970. Between 1970 and 1988, total capture fisheries production in the region (Figure 5) increased irregularly from 1 000 000 tonnes to almost 1 788 000 tonnes. 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 then subsequently declined irregularly to 750 000 tonnes in 2015. Over the following three years, production reached 806 040 tonnes in 2018, but it notably decreased to 660 450 tonnes in 2021. 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 2021, when reported landings in the Black Sea totalled 386 500 tonnes. The drop in landings in 2020 and 2021 was also likely exacerbated by COVID-19 restrictions, which not only included temporal closures on fishing activities, but also a nearly total shutdown of tourism with impacts on trade and a decrease in demand (GFCM, 2020).

FIGURE 5. Total landings in the Mediterranean and the Black Sea, 1970–2021



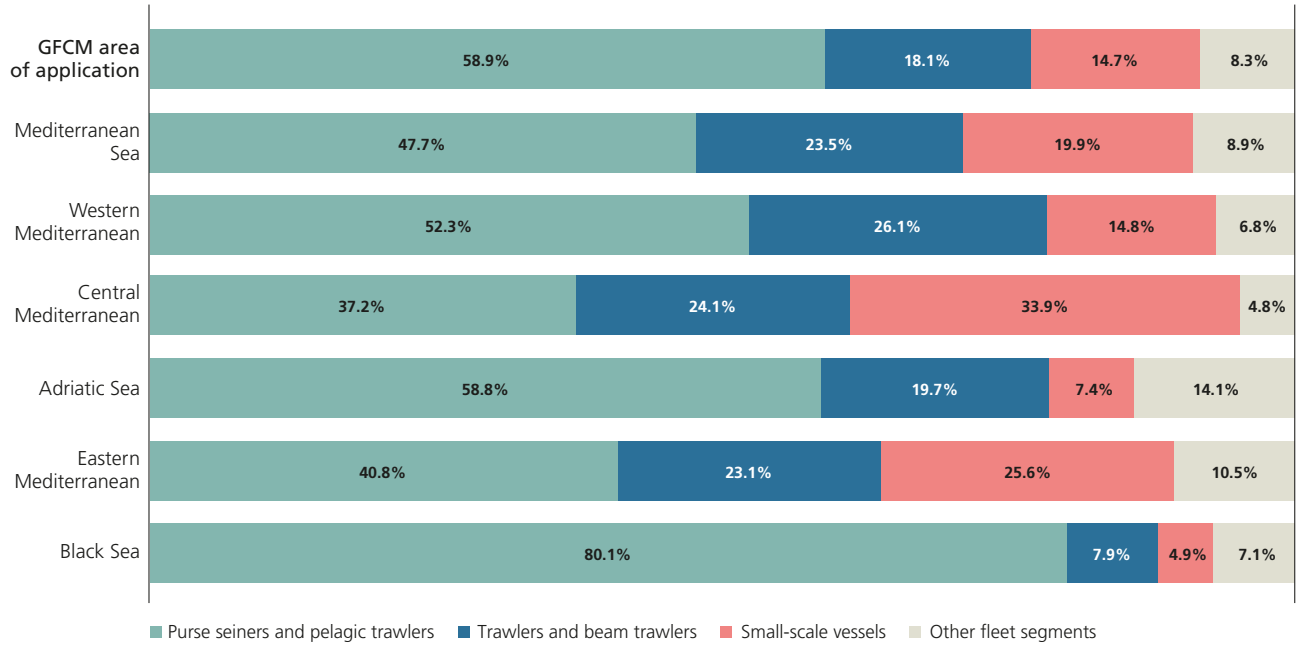
Note: Left panel shows cumulative trends from the Mediterranean and the Black Sea; right panel shows trends by basin (Mediterranean and Black Sea).

As shown in Figure 5, annual landings for the Mediterranean and the Black Sea (averaged over 2020–2021) amount to 1 063 200 tonnes (excluding tuna-like species), showing a decline of 14.5 percent compared to the previous biennium (2018–2019 average), most likely related to the impacts of the COVID-19 pandemic on fleet dynamics, demand and trade. Türkiye continues to be the main producer (296 478 tonnes, 28 percent of total landings), followed by Italy (122 110 tonnes, 11.5 percent) and Tunisia (107 817 tonnes, 10.1 percent). In terms of variation over the last two biennia (2020–2021 vs 2018–2019), catches declined in most countries, with the strongest dips in Italy (–49 177 tonnes, –28.7 percent), Türkiye (–42 103 tonnes, –12.4 percent) and Algeria (–34 471 tonnes, –33 percent).

LANDINGS BY FLEET SEGMENT GROUP

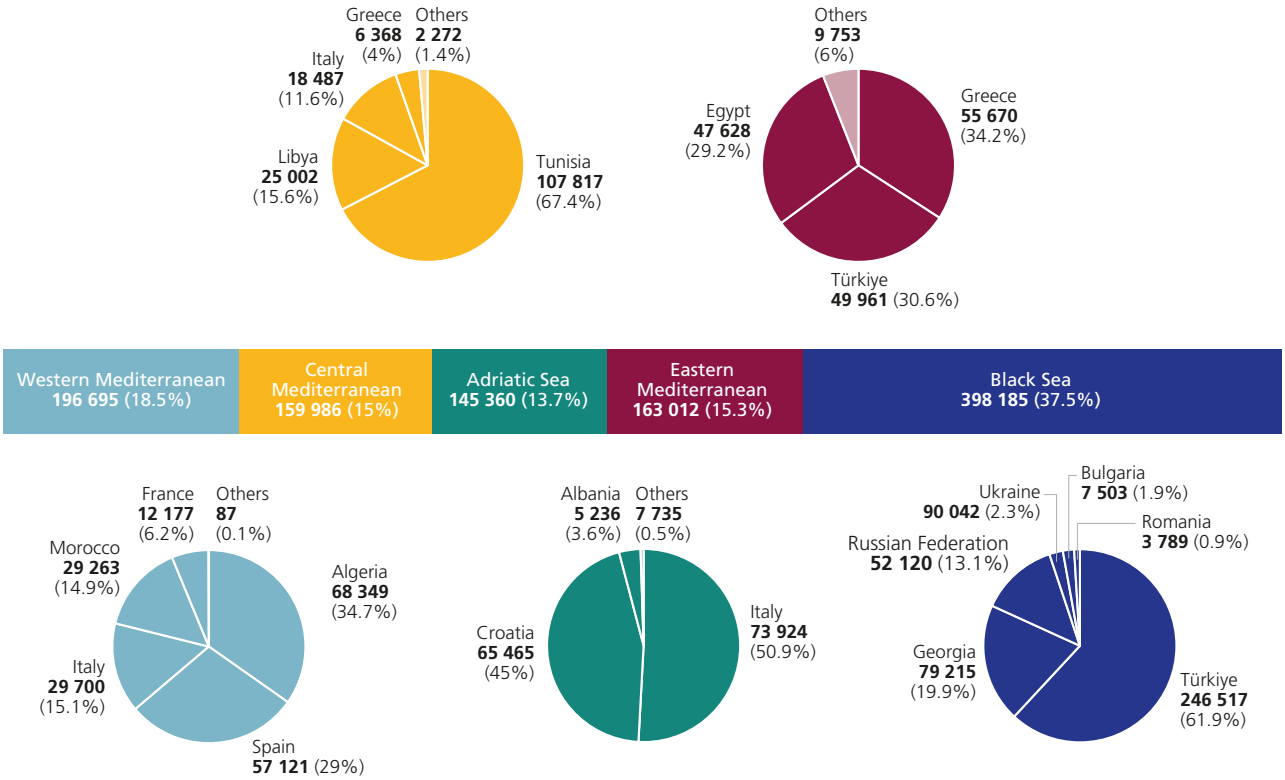
The "Purse seiners and pelagic trawlers" group is the fleet segment responsible for the largest share of total landings (58.9 percent) in the GFCM area of application, accounting for 47.7 percent of landings in the Mediterranean Sea (ranging from 37.2 percent in the central Mediterranean to 58.8 percent in the Adriatic Sea) and 80.1 percent in the Black Sea (Figure 6). The "Trawlers and beam trawlers" group makes the second largest contribution to total landings (18.1 percent) and has a greater relative importance (23.5 percent) in the Mediterranean (where the western Mediterranean shows the highest peak, at 26.1 percent) than in the Black Sea (7.9 percent). The "Small-scale vessels" group is better represented in Mediterranean landings (19.9 percent of the total, reaching 33.9 percent in the central Mediterranean) than in the Black Sea (4.9 percent). Finally, the miscellaneous group "Other fleet segments" accounts for 8.3 percent of the total, with a slightly higher share of landings in the Mediterranean (8.9 percent in total, peaking in the Adriatic Sea at 14.1 percent) than in the Black Sea (7.1 percent).

FIGURE 6. Relative contributions of the fleet segment groups to total landings, 2020–2021



Note: Bosnia and Herzegovina (Adriatic Sea), Libya (central Mediterranean), the Russian Federation (Black Sea) and the Syrian Arab Republic (eastern Mediterranean) are not included in the chart, as these countries provided no data on their national landings by fleet segment of the GFCM Data Collection Reference Framework.

FIGURE 7. Average annual landings by GFCM subregion and country, 2020–2021



Notes:
Landings are expressed in tonnes.
Percentages indicate relative contributions of GFCM subregions to total landings in the GFCM area of application and of countries to total landings in their respective GFCM subregions, 2020–2021 averages.

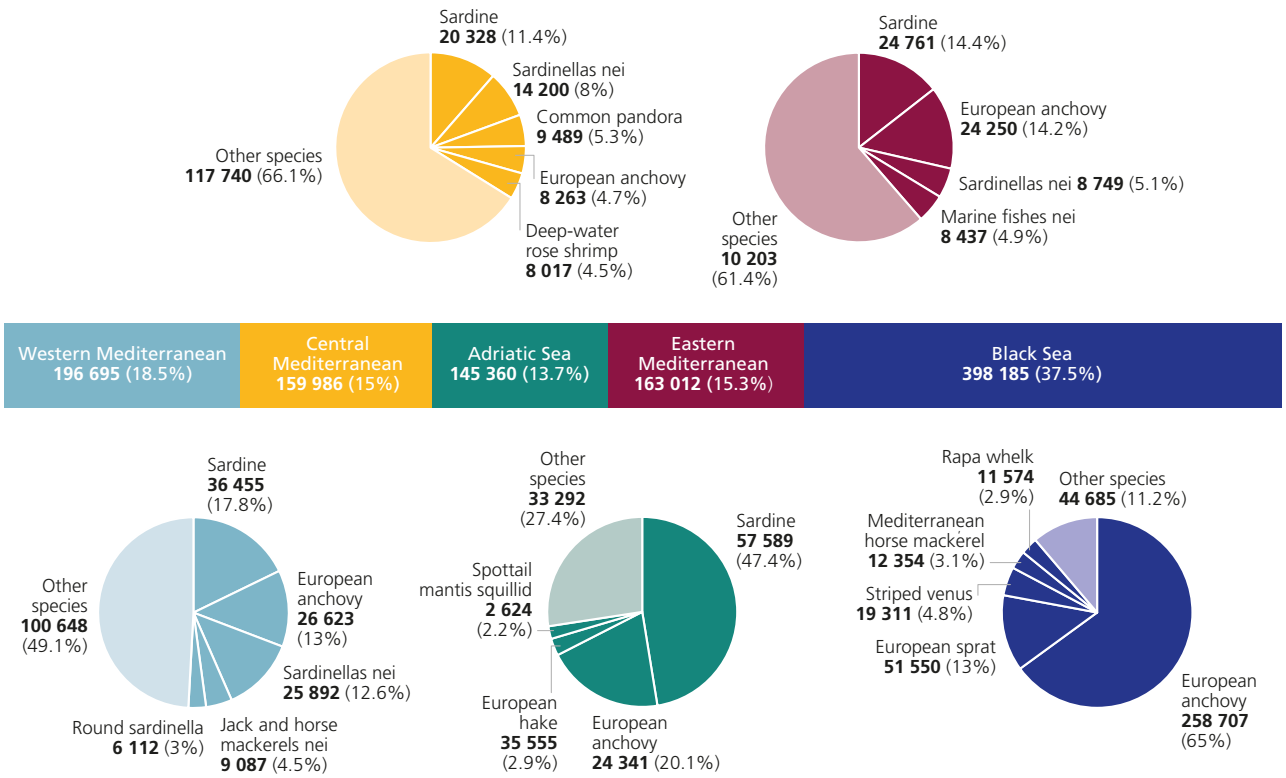
LANDINGS BY COUNTRY AND SUBREGION

Figure 7 shows that 37.5 percent of total landings (398 185 tonnes) are produced in the Black Sea, while the remaining 62.5 percent (665 053 tonnes) are split among the Mediterranean subregions as follows: 18.5 percent come from the western Mediterranean (196 695 tonnes), while the central and eastern Mediterranean record a similar share of around 15 percent (159 986 and 163 012 tonnes, respectively), followed by the Adriatic Sea (13.7 percent, 145 360 tonnes).

In the western Mediterranean, three countries together account for 78.8 percent of all landings by weight in the subregion: Algeria (34.7 percent), Spain (29 percent) and Italy (15.1 percent). Italy (50.9 percent) and Croatia (45 percent) together represent 95.9 percent of all landings in the Adriatic Sea. Meanwhile, in the central Mediterranean, three countries are responsible for 94.6 percent of all landings by weight, with Tunisia (67.4 percent) as the main contributor, followed by Libya (15.6 percent) and Italy (11.6 percent). In the eastern Mediterranean, landings by weight are mostly split between Greece (34.2 percent), Türkiye (30.6 percent) and Egypt (29.2 percent), which together account for 94 percent of all landings in the subregion. Finally, Türkiye contributes the largest share of landings by weight (61.9 percent) in the Black Sea, followed by Georgia (19.9 percent), the Russian Federation (13.1 percent)[2], Ukraine (2.3 percent), Bulgaria (1.9 percent) and Romania (0.9 percent).

[2] Information on the Russian Federation's total capture fisheries production is based on data reported to FAO through the STATLANT 37A questionnaire.

FIGURE 8. Average annual landings by GFCM subregion and main landed species, 2020–2021



Notes:
Landings are expressed in tonnes.
Percentages indicate relative contributions of GFCM subregions to total landings in the GFCM area of application and of main landed species to total landings in their respective GFCM subregions, 2020–2021 averages.

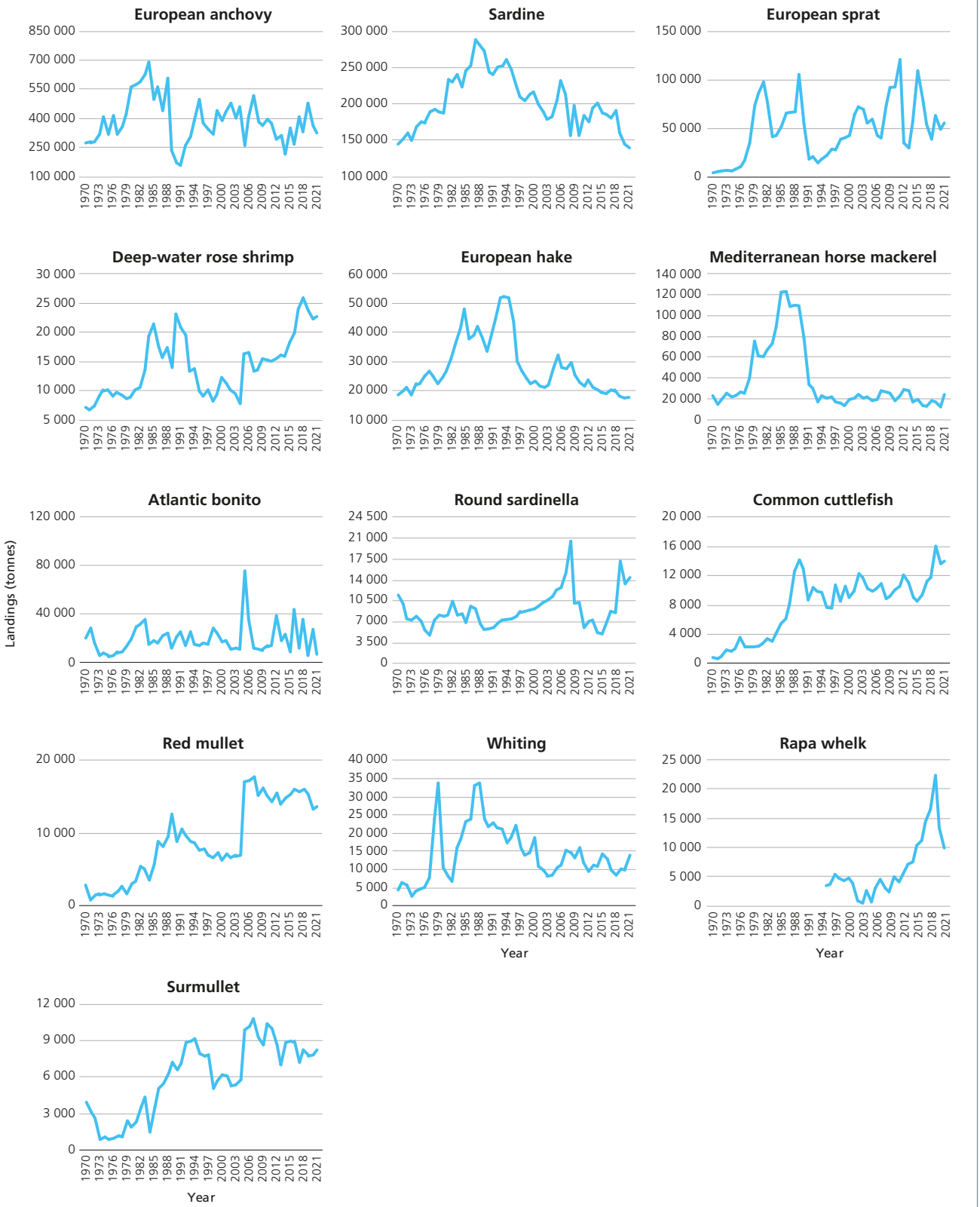
LANDINGS BY SPECIES AND SUBREGION

Landings in the GFCM area of application remain largely dominated by small pelagic fish, mainly European anchovy (*Engraulis encrasicolus*), at 342 000 tonnes, and sardine (*Sardina pilchardus*), at 141 400 tonnes. As shown in Figure 8, European anchovy and sardine are the two predominant species in the Adriatic Sea (contributing 20.1 percent and 47.4 percent of total landings, respectively), western Mediterranean (13 percent and 17.8 percent) and eastern Mediterranean (14.2 percent and 14.4 percent) whereas sardinellas nei (*Sardinella* spp.) and European sprat (*Sprattus sprattus*) are the second most important species in terms of landings in the central Mediterranean (8 percent) and the Black Sea (13 percent), respectively.

The overall diversity of species, represented by the lowest number of species that can be summed together to account for 90 percent of the total catch, is much lower in the Black Sea (five species) than in the Mediterranean Sea (55 species, ranging from 15 in the Adriatic Sea to 44 in the western Mediterranean).

A variety of dynamics emerge from examining the trends in landings of main priority species over the period 1970–2021 (Figure 9). Landings of all the main pelagic species show wide fluctuations, particularly European anchovy, but also sardine, European sprat and round sardinella (*Sardinella aurita*). A number of the main demersal species have followed an overall increasing trend in landings: deep-water rose shrimp (*Parapenaeus longirostris*) (from 7 000 tonnes in 1970 to 22 700 tonnes in 2021), common cuttlefish (*Sepia officinalis*) (from 830 tonnes in 1970 to 14 033 tonnes in 2021), rapa whelk (*Rapana venosa*) (from 3 423 tonnes in 1995 to 9 923 tonnes in 2021), red mullet (*Mullus barbatus*) (from 2 800 tonnes in 1970 to 13 570 tonnes in 2021) and surmullet (*Mullus surmuletus*) (from 3 934 tonnes in 1970 to 8 243 tonnes in 2021). In contrast, the landings of several species have decreased in recent years, including European hake (*Merluccius merluccius*) (from 52 394 tonnes in 1994 to 17 824 tonnes in 2021) and whiting (*Merlangius merlangus*) (from 22 777 tonnes in 1991 to 13 825 tonnes in 2021).

FIGURE 9. Annual landings of priority species averaging higher than 5 000 tonnes per year in the GFCM area of application, 1970–2021



3. Socioeconomic characteristics

This chapter provides an update of the latest information available on key socioeconomic indicators for the Mediterranean and Black Sea region, namely revenue and employment, supporting the assessment of the social and economic performance of the region's fishing sector.

The data used stem from data submissions to the GFCM Data Collection Reference Framework (DCRF) Task VI relating to socioeconomic aspects (GFCM, 2018). All monetary values have been adjusted for inflation and are listed as constant 2021 USD to facilitate comparison across reference years (World Bank, 2023a, 2023b).

The reference year for the information presented is 2021, with some exceptions where 2021 data were unavailable or incomplete and it was necessary to use data from previous years.[3, 4] Data for Bosnia and Herzegovina, Libya and the Syrian Arab Republic, as well as the Russian Federation and Palestine, were not included in the present analyses due to a lack of availability.

[3] Reference years are as follows: 2021 for Bulgaria, Croatia, Cyprus, France, Greece, Israel, Italy, Malta, Morocco, Romania, Slovenia and Spain; 2020 for Algeria and Türkiye; 2019 for Montenegro and Ukraine; 2018 (as previously published in *The State of Mediterranean and Black Sea Fisheries 2022* [FAO, 2022a]) for Albania, Egypt, Lebanon and Tunisia.

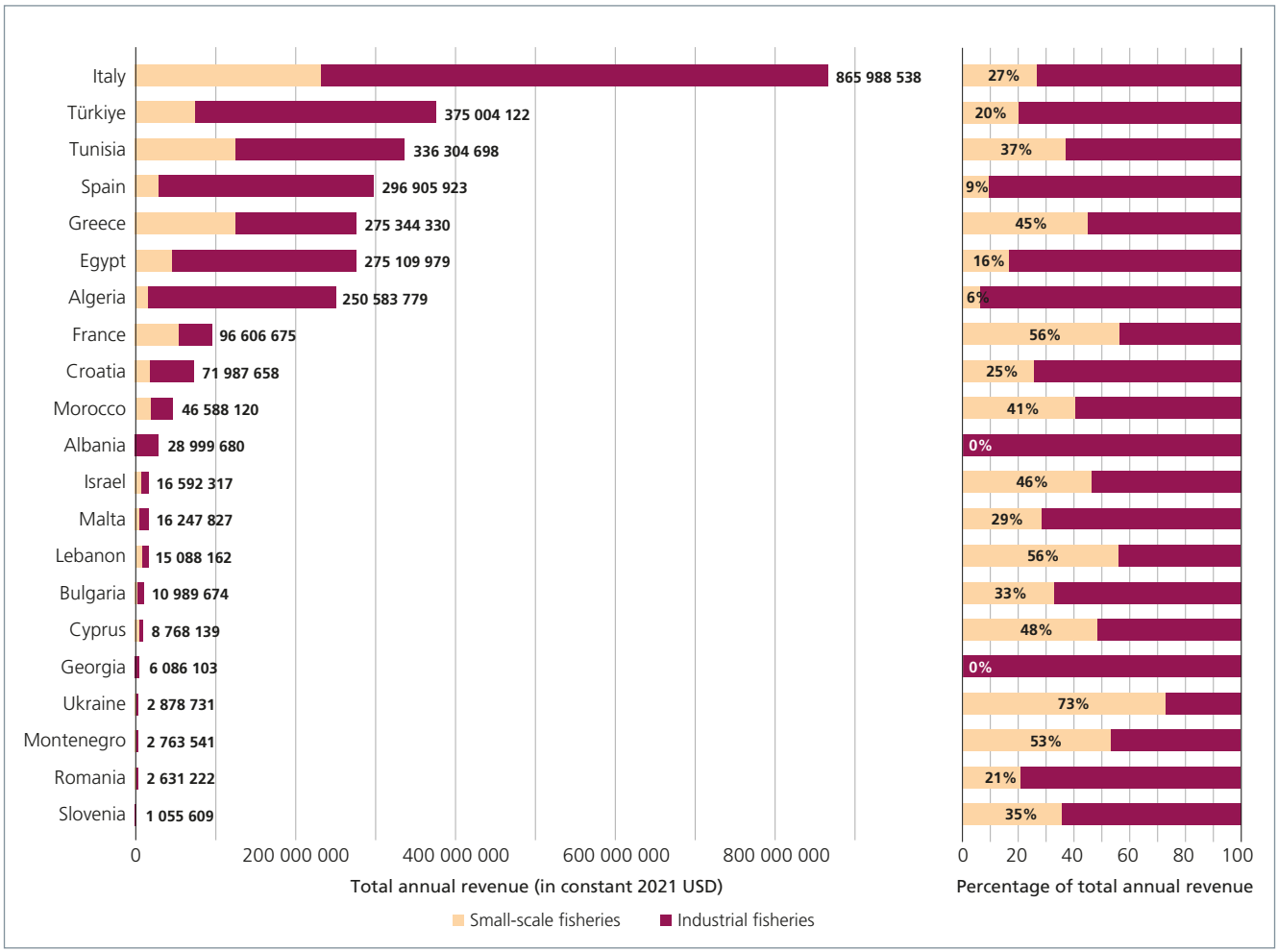
[4] Data presented for Ukraine refer to 2019 and as such do not include the impacts of the war in Ukraine. A preliminary analysis of the impacts of this conflict on the fisheries and aquaculture sector was carried out and reported in *The State of World Fisheries and Aquaculture 2022* (FAO, 2022b, p. 223).

REVENUE

The total revenue from marine capture fisheries in the GFCM area of application in 2021 was estimated at USD 3 billion (USD 2.7 billion in the Mediterranean and USD 256 million in the Black Sea). This figure captures 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-adding activities. Information on revenue from shore-based fishing activities, such as gleaning (i.e. foot-based fishing, including shellfish collecting), was not available and therefore not considered in this estimate. The total revenue from fisheries in 2021 represents a slight increase (of approximately USD 39 million) from 2020, which was the reference year for *The State of Mediterranean and Black Sea Fisheries 2022* (FAO, 2022a).

Small-scale fisheries (SSF) contribute, on average, 26 percent of the sector's total regional revenue (27 percent in the Mediterranean and 15 percent in the Black Sea), representing a decrease of 1 percent from the previous edition of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2022a). However, the share of revenue from SSF varies widely among the countries of the region. In four countries – namely France, Lebanon, Montenegro and Ukraine – the contribution of SSF represents over 50 percent of the total revenue from marine capture fisheries (Figure 10).

FIGURE 10. Revenue from marine capture fisheries by GFCM contracting party and cooperating non-contracting party



EMPLOYMENT

Total employment on board fishing vessels (part-time and full-time included) in the GFCM area of application[5] is 183 000 people (158 000 in the Mediterranean and 25 000 in the Black Sea) (Figure 11). Non-vessel-based employment, such as work carried out in the pre- and post-harvest sectors and by gleaners and through other shore-based activities, as well as the frequently "invisible" work of women (FAO, 2017; European Commission, 2019) are not captured by this employment figure. Over 80 percent of total employment in fisheries in the region comes from just six countries, namely Tunisia, Türkiye, Egypt, Italy, Greece and Morocco. Compared to the reference year 2020, total employment continues to decline, albeit at a slower rate, decreasing by approximately 6 percent regionally between 2020 and 2021 (compared to a 14 percent decrease between 2018 and 2020).

At the regional level, SSF contribute to 61 percent of total employment on board fishing vessels (62 percent in the Mediterranean and 57 percent in the Black Sea). This value represents an increase of 2 percent from *The State of Mediterranean and Black Sea Fisheries 2022* (FAO, 2022a), indicating that while overall employment is declining, this decrease is occurring primarily in the industrial fishing sector. In six countries, namely Bulgaria, Cyprus, Greece, Montenegro, Slovenia and Ukraine, SSF account for over 80 percent of total employment (Figure 11).

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

FIGURE 11. Employment on board small-scale and industrial fishing vessels by GFCM contracting party and cooperating non-contracting party

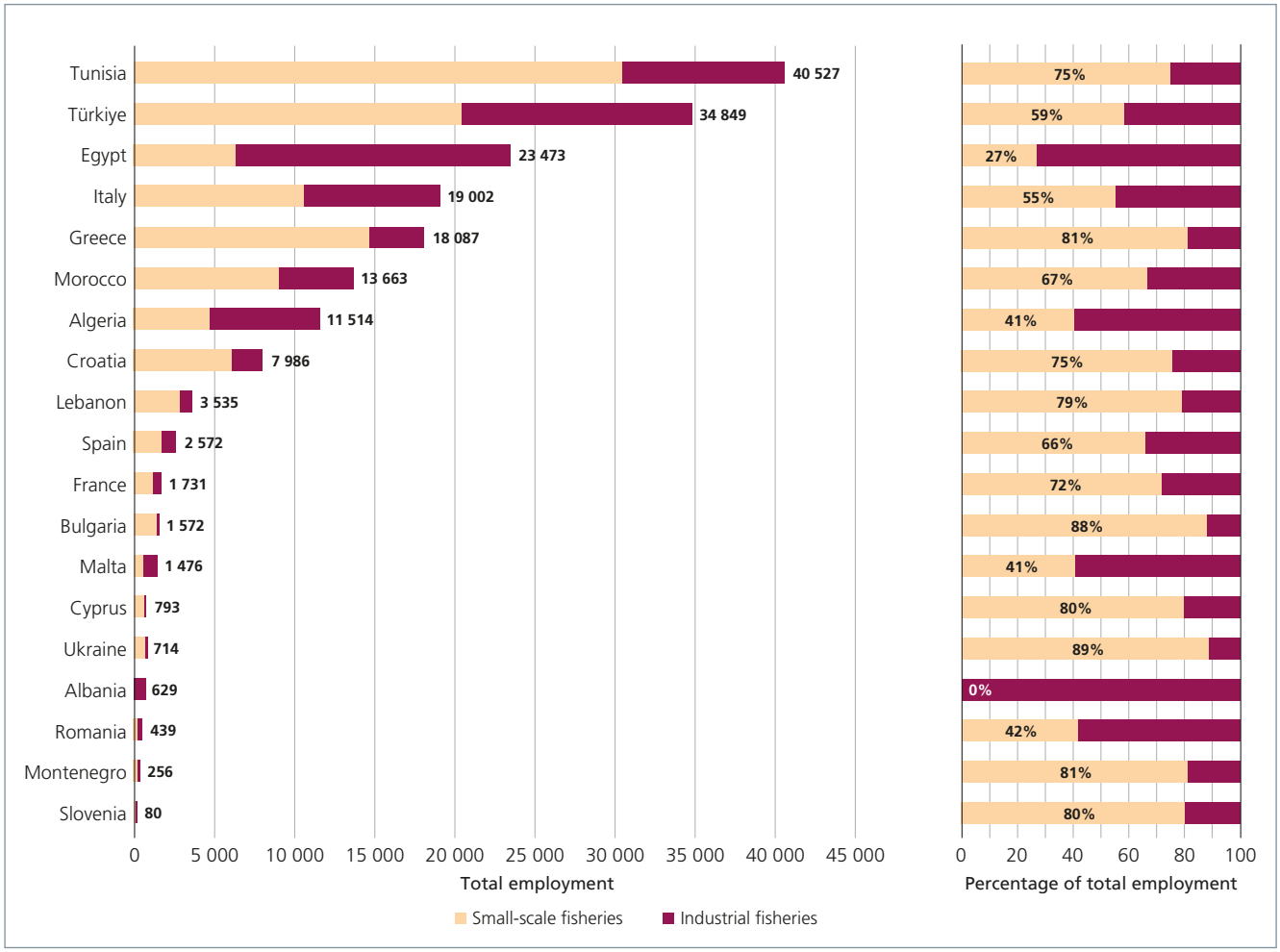
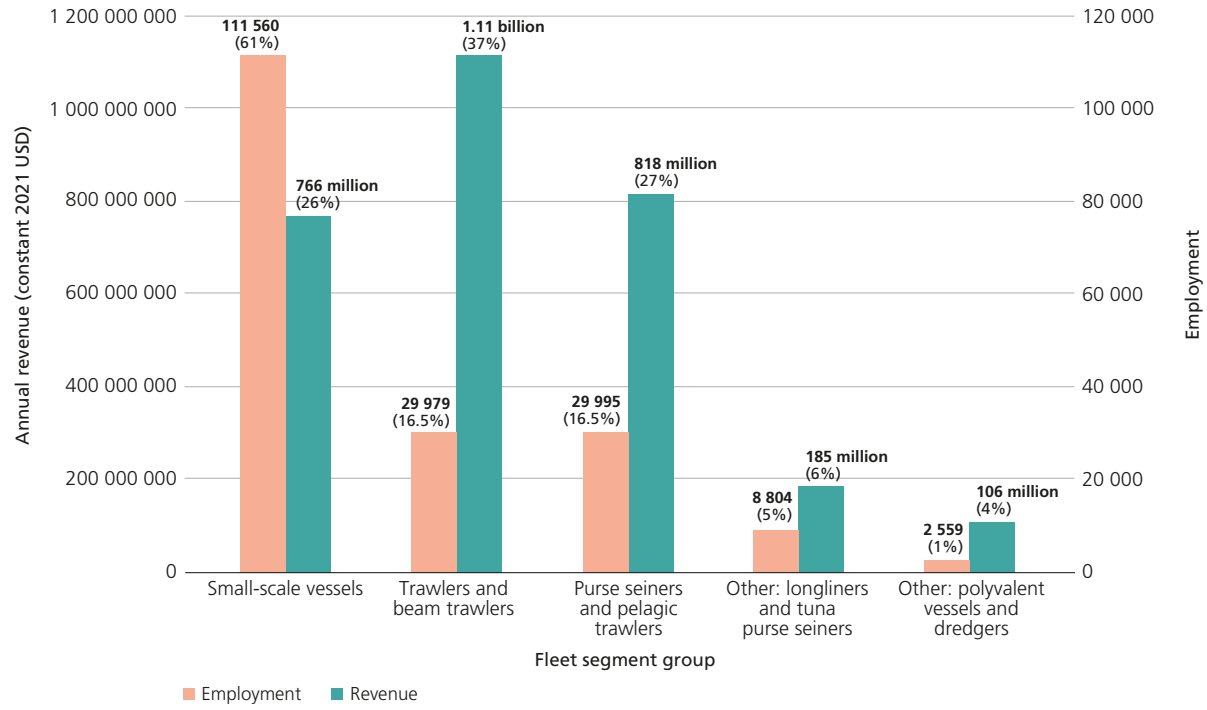


FIGURE 12. Comparison of revenue and employment by fleet segment group in the GFCM area of application



Notes:
Information from Georgia and Ukraine are not included in this figure.
Percentages indicate the relative contributions of fleet segment groups to revenue and employment totals in the GFCM area of application.

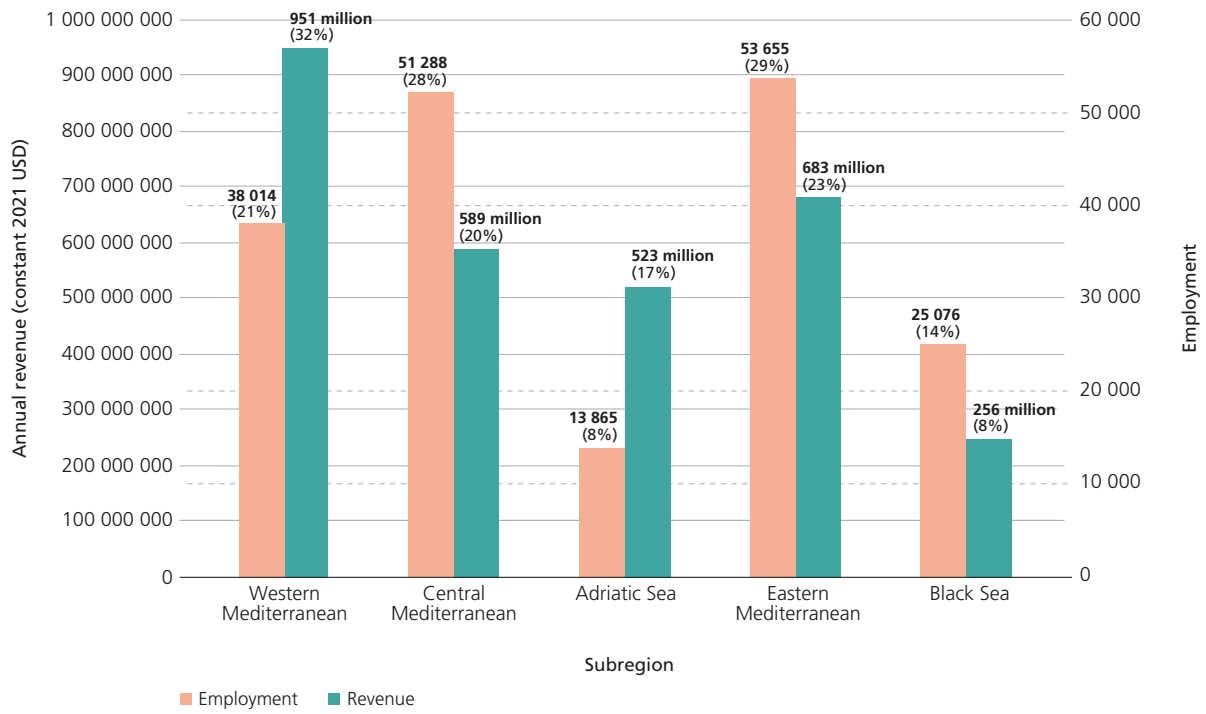
FLEET SEGMENT COMPARISON

Figures 10 and 11 show an imbalance in the distribution of benefits between SSF and industrial fisheries. As noted previously, SSF generate 61 percent of total employment but bring in only 26 percent of total revenue, with these values inverted for industrial fisheries. However, comparisons of revenue by fleet segment group (Figure 12) show that revenue from SSF is comparable to revenue from the "Purse seiners and pelagic trawlers" group, which is the second highest revenue-generating fleet segment group after "Trawlers and beam trawlers" (37 percent of total revenue).

SUBREGIONAL COMPARISON

Benefits from fisheries are more evenly distributed at the subregional level (Figure 13). The eastern Mediterranean is the region with the highest employment in the fishing sector (29 percent of total employment), closely followed by the central Mediterranean (28 percent of total employment). While these two subregions also produce an important share of regional revenue (23 percent and 20 percent, respectively), the western Mediterranean earns the highest portion of revenue in the region (32 percent of total revenue).

FIGURE 13. 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.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4. Discards

This chapter focuses on discards data, updating the analysis presented in previous editions of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2020, 2022a), while the most recent data and information on the incidental catch of vulnerable species have been analysed and presented in the last edition (FAO, 2022a). Updates are given in this chapter on the discard levels of different fisheries (including bottom trawlers, purse seiners, set longliners and small-scale fisheries) within the GFCM area of application. Three main sources were used: i) the latest data from GFCM Data Collection Reference Framework Subtask II.2 "Catch data per species", which covers landings and discards by geographical subarea (GSA) and vessel group for main commercial species (GFCM, 2018); ii) the latest report of the GFCM Working Group on the analysis of fisheries monitoring data, which jointly analysed the most recent data and information gathered during various discards monitoring activities carried out in the Mediterranean and the Black Sea (GFCM, 2023a); and iii) data summarized in recent

scientific publications. The ratios of discards to total catch (i.e. discard fraction/total catch × 100) have been estimated according to GFCM subregion and major vessel group based on a combination of these data. To compare discards between subregions and across editions of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2016, 2018, 2020, 2022a), fisheries were classified into three broad categories based on their discard ratios: high discard ratio (> 40 percent of total catch in weight), medium discard ratio (15–40 percent) and low discard ratio (< 15 percent).

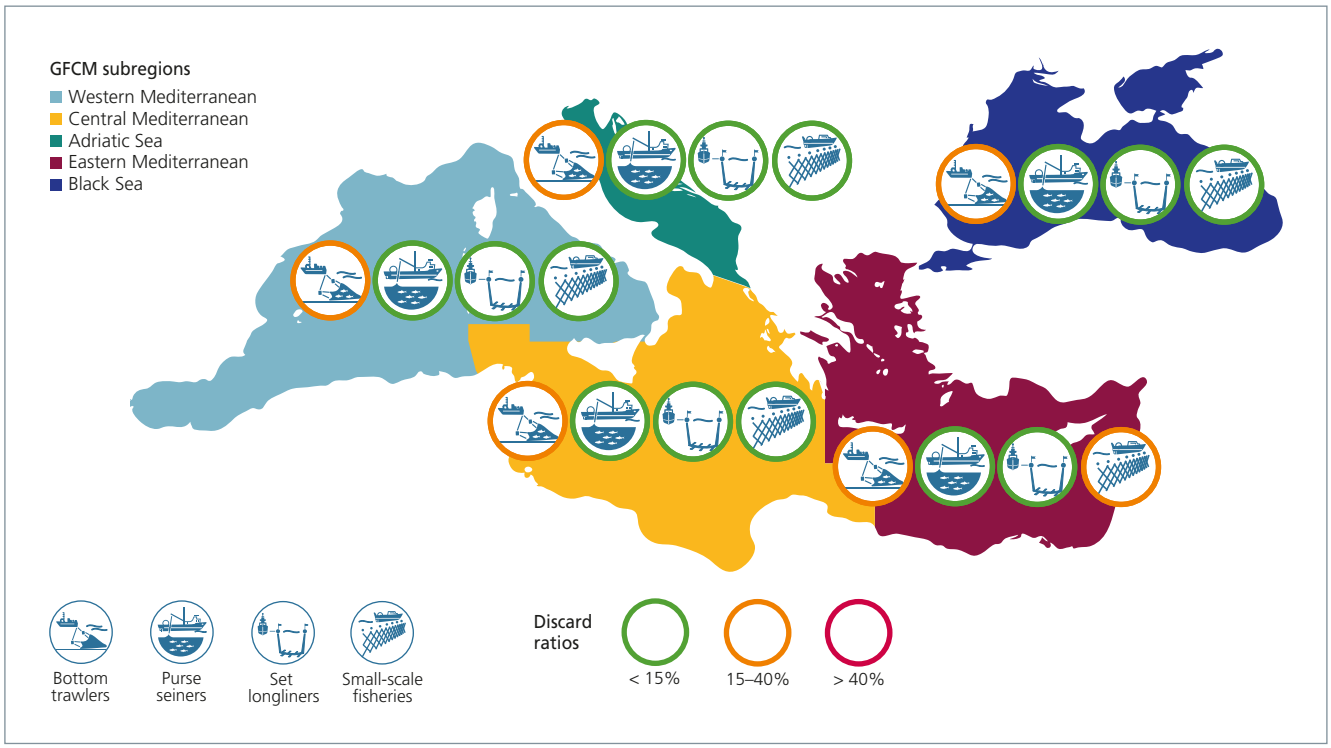
DISCARDS BY MAJOR VESSEL GROUP

Bottom trawlers

Several bottom trawl fisheries are active across the GFCM area of application, with both landing compositions and discards varying according to target species and depth (FAO, 2022a; Blanco *et al.*, 2023). Bottom trawling is characterized by medium discard ratios (between 15 and 40 percent) in all Mediterranean subregions and the Black Sea (Figure 14). Based on the latest analysis, the highest discard ratio values were recorded from the Adriatic Sea (around 33 percent), while in other GFCM subregions, values ranged between 15 and 30 percent. Slight decreases from the evaluations performed in the first two editions of *The State of Mediterranean and Black Sea Fisheries* (FAO, 2016, 2018), which reported discard ratios higher than 40 percent in the majority of subregions, may be linked to the adoption of technical and spatial restrictions, for example following the entry into force of the landing obligation in European countries (European Parliament and Council of the European Union, 2013).

At the subregional level, the analysis confirmed that the discard ratios of important commercial species, such as European hake (*Merluccius merluccius*) and deep-water rose shrimp (*Parapenaeus longirostris*), are very low (generally below 6 percent of the total catch by species), while the two deep-water red shrimps – giant red shrimp (*Aristaeus antennatus*) and blue and red shrimp (*Aristaeomorpha foliacea*) – and Norway lobster (*Nephrops norvegicus*) are discarded at

FIGURE 14. Discard ratios of bottom trawlers, purse seiners, set longliners and small-scale fisheries, by GFCM subregion



negligible rates (below 2 percent) throughout the basin. The two coastal species red mullet (*Mullus barbatus*) and surmullet (*Mullus surmuletus*) show highly fluctuating discard ratios (from 1 to 20 percent), depending on the area and the period. Higher discard ratios (generally above 40 percent), mainly concentrated in some areas of the eastern Mediterranean, are dominated by non-indigenous species, including devil firefish (*Pterois miles*), silver-cheeked toadfish (*Lagocephalus sceleratus*) and striped piggy (*Pomadasys stridens*) (Acarli, Kale and Çakir, 2022; Cerim *et al.*, 2022).

Purse seiners

Despite accounting for an important proportion of the total catch in the Mediterranean and the Black Sea, purse seiners, exploiting mainly European anchovy (*Engraulis encrasicolus*), sardine (*Sardina pilchardus*) and round sardinella (*Sardinella aurita*), are characterized by relatively low discard ratios in all subregions (generally well below 15 percent) (Figure 14). Nevertheless, discard ratios in purse seine fisheries vary depending on the presence of sorting machines (or length grading machines), which separate fish on deck according to their size (GFCM, 2023a). When a sorting machine is employed, the discard ratio can exceed 15 percent, while without a sorting machine, the discard ratio remains below 15 percent.

Set longliners

Compared to other vessel groups, set longliners are highly selective, and discards are relatively low (below 5 percent) in all subregions (GFCM, 2023a) (Figure 14). Discarded species mostly include elasmobranchs (e.g. blackmouth catshark [*Galeus melastomus*], small-spotted catshark [*Scyliorhinus canicula*], piked dogfish [*Squalus acanthias*] and rays [*Raja* spp.]), other species of low commercial value (e.g. sargo breams nei [*Diplodus* spp.] and European conger [*Conger conger*]) and non-indigenous species (e.g. silver-cheeked toadfish).

Small-scale fisheries

The multispecies and multigear nature of Mediterranean and Black Sea small-scale fisheries, which account for 80 percent of the region's total fishing vessels, makes it challenging to monitor and study discards, resulting in scarce and limited information in some areas.

Small-scale fisheries (e.g. fisheries using trammel nets, gillnets, combined nets or small longliners) seem to produce relatively low discard ratios, with estimates around 10 percent of the total catch in almost all subregions (Figure 14) and with trammel nets showing slightly higher discard ratio values than gillnets. Recent data (GFCM, 2023a; Papageorgiou and Moutopoulos, 2023; Kalogirou *et al.*, 2022), covering mainly the eastern Mediterranean, showed that discards have increased (ranging between 15 and 40 percent) and been dominated by non-indigenous species, e.g. redcoat (*Sargocentron rubrum*), reticulated leatherjacket (*Stephanolepis diaspros*), grey triggerfish (*Balistes capriscus*), silver-cheeked toadfish, yellow-spotted puffer (*Torquigener flavimaculosus*) and devil firefish.

CONCLUSIONS

The results presented in this chapter are consistent with previous editions of *The State of Mediterranean and Black Sea Fisheries* and with other studies conducted in the region (FAO, 2016, 2018, 2020, 2022a; Tsagarakis, Palialexis and Vassilopoulou, 2014; Blanco *et al.*, 2023). The main new developments are: i) a slight reduction in discard ratios of bottom trawlers, potentially linked to the adoption of technical and spatial restrictions (European Parliament and Council of the European Union, 2013); and ii) an increase in the presence of non-indigenous species in the discards fraction of bottom trawlers, set longliners and small-scale fisheries.

This analysis confirms how discard levels in Mediterranean and Black Sea fisheries vary between areas, fishing grounds, species and types of gear and are clearly dependent on a number of variables, including gear selectivity, fishing season, depth, soaking time, fisher behaviour, markets, and fluctuations in the abundance of juvenile fish and non-indigenous species (Table 1). Undersized fish may also be discarded due to minimum length size regulations, with less valuable size classes of

TABLE 1. Composition of the main landed and discarded portions of catch, by fishery operating in the GFCM area of application

	Discard ratio < 15%			Discard ratio 15–40%
	Purse seiners	Small-scale fisheries	Set longliners	Bottom trawlers
Target species/family in landed catch	European anchovy, sardine, jack and horse mackerels nei (*Trachurus* spp.), sardinellas nei (*Sardinella* spp.), scomber mackerels nei (*Scomber* spp.), bogue, bluefish	Red mullet, surmullet, turbot, common sole, common cuttlefish, spottail mantis shrimp, common octopus, seabreams nei (Sparidae), rabbitfishes nei (*Siganus* spp.), scorpionfishes (*Scorpaena* spp.), mullets nei (Mugilidae), Penaeus shrimps nei (*Penaeus* spp.)	European hake, seabreams nei (Sparidae), groupers, seabasses nei (Serranidae), blackspot seabream, European conger, gurnards (Triglidae)	Red mullet, European hake, common sole, common cuttlefish, giant red shrimp, surmullet, Norway lobster, blue and red shrimp, deep-water rose shrimp, common pandora, common octopus, jack and horse mackerels nei (*Trachurus* spp.), whiting, spottail mantis shrimp, gurnards (Triglidae), Penaeus shrimps nei (*Penaeus* spp.)
Discards composition	Small or damaged individuals of target species; other pelagic fish	Macroinvertebrates; non-indigenous species; other demersal fish	Elasmobranchs; juveniles of target species; other demersal fish; non-indigenous species	Gastropods; cnidarians; echinoderms; other demersal fish; bivalves; elasmobranchs, e.g. velvet belly, blackmouth catshark, *Nezumia* spp., tope shark; non-indigenous species; small individuals of target species
Reasons for discarding	Species with low or no commercial value; undersized specimens; specimens that are damaged or in poor condition	Species with low or no commercial value; undersized specimens; specimens that are damaged or in poor condition	Species with low or no commercial value; specimens that are damaged or in poor condition; vulnerable species	Species with low or no commercial value; undersized specimens; damaged specimens; vulnerable species

target species being discarded in favour of more valuable size classes.

The great efforts devoted in recent years to the implementation of sound, standardized sampling methodologies (FAO, 2019), as well as to improving techniques to provide reliable discard estimates, have enabled the analysis of more consistent datasets across different areas and countries. However, there still remains room for improvement. Data collection and discard estimates for all commercial species and fisheries are crucial for sound fisheries management, but this information is far from complete, and the available data still show low precision. Indeed, absent or poor-quality discard data may result in an underestimation of exploitation rates, leading to biased assessments and consequent difficulties in supporting a correct formulation of scientific advice. For example, discards still represent a major source of uncertainty surrounding the actual fishing mortality rates of several commercial stocks.

5. Status of fishery resources

Updating the data provided in *The State of Mediterranean and Black Sea Fisheries 2022* (FAO, 2022a), this chapter summarizes the current status of fish stocks in the Mediterranean and the Black Sea, with a focus on the overall status of stocks and on changes in stock assessment coverage and exploitation ratios from 2020 to 2021. Improvements are evident since this previous edition: the percentage of stocks in overexploitation and fishing pressure exerted have decreased, while the percentage of landings providing the basis for quantitative advice has increased and all assessed priority species, except blue and red shrimp (*Aristeus antennatus*), show decreasing trends in exploitation. Nevertheless, many stocks are still fished outside biologically sustainable limits. For a review of the management measures in place to address these important stocks, see Chapter 7.

COVERAGE OF ADVICE ON STOCK STATUS

The number of non-deprecated validated assessments, i.e. assessments from previous years that are still considered to be valid (for a period of three years for small pelagic stocks and five years for demersal stocks), has continued to increase progressively in recent years, reaching a total of 116 in 2021 (15 more than in 2020) (Table 2) and covering 28 out of the 30 geographical subareas in the

Mediterranean and the Black Sea. Of validated assessments (Table 2), 94 percent were carried out in 2021, while 87 percent of non-deprecated assessments provide quantitative advice. With new assessments performed for Black Sea anchovy (*Engraulis encrasicolus ponticus)* and rapa whelk (*Rapana venosa*), two species with large catches in the region, the percentage of landings assessed in 2021 reached its highest point in the time series, at 50 percent (Figure 15). These results reflect a continued improvement in the spatial and temporal coverage of the stocks for which scientific advice is provided.

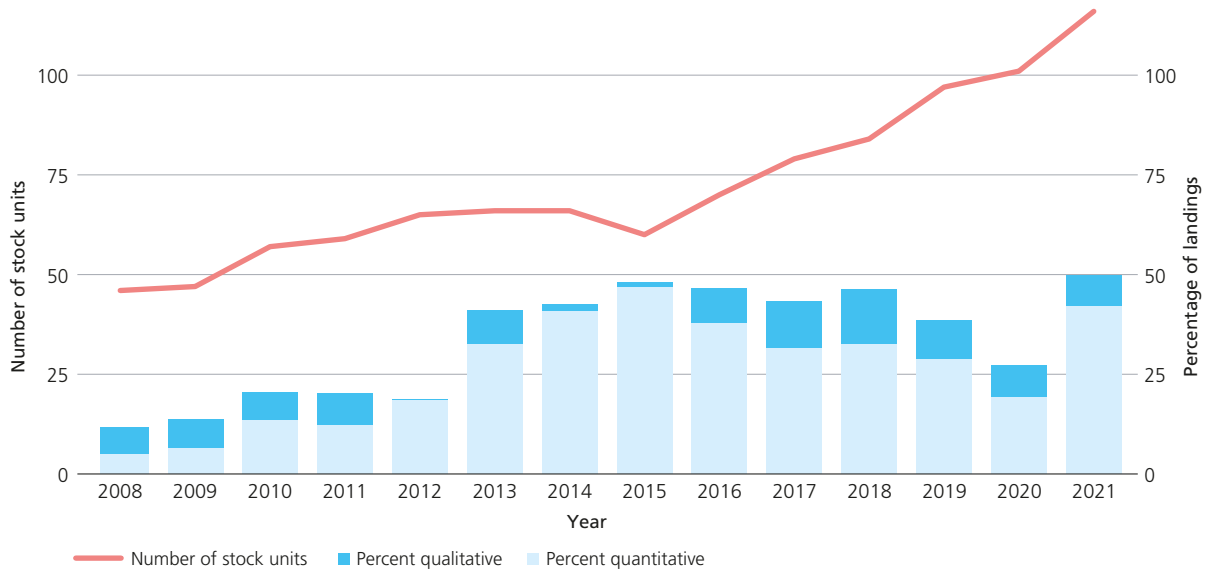
OVERVIEW OF THE STATUS OF STOCKS

Although the number of stocks for which biomass reference points are estimated in the GFCM area of application is increasing every year, this number is not large enough yet to provide confident advice on a biomass basis at basin scale. Consequently, the percentage of stocks

TABLE 2. Number of validated and non-deprecated stock assessments available per year, 2003–2021

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	66
2015	38	60
2016	57	70
2017	56	79
2018	49	84
2019	73	97
2020	79	101
2021	86	116

FIGURE 15. Number of stock units and percentage of declared landings assessed qualitatively and quantitatively per year, 2008–2021



Notes:
The red line represents the number of stock units assessed and the bar chart represents the percentages of declared landings assessed on qualitative and quantitative bases 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.

fished outside biologically sustainable limits on a regional basis is still estimated by comparing the level of fishing mortality to the fishing mortality reference point. The reduction in the percentage of stocks in overexploitation observed since 2014 has continued, decreasing by an additional 15 percent since *The State of Mediterranean and Black Sea Fisheries 2022* (FAO, 2022a) and reaching 58 percent in 2021 (Figure 16). While more than half the stocks for which validated assessments are available are fished outside biologically sustainable limits and fishing pressure remains twice what is considered sustainable (F/F_{MSY} = 2.13), there has been a 31 percent reduction in this ratio since 2012 and the current ratio represents the lowest in the time series (Figure 17).

FIGURE 16. Percentage of stocks in overexploitation in the GFCM area of application, 2006–2021

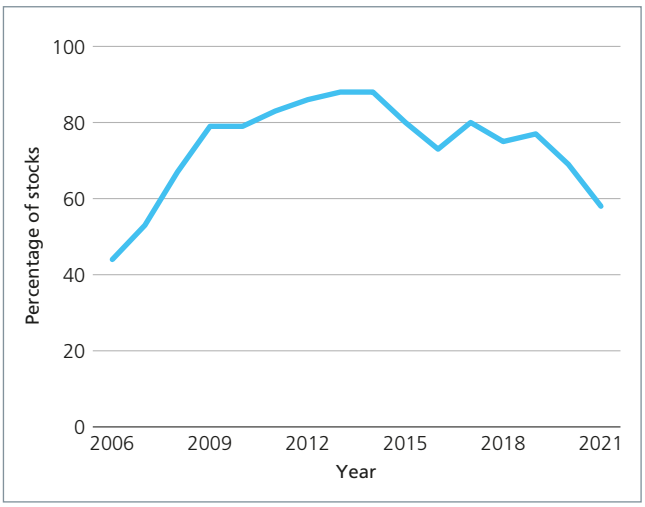
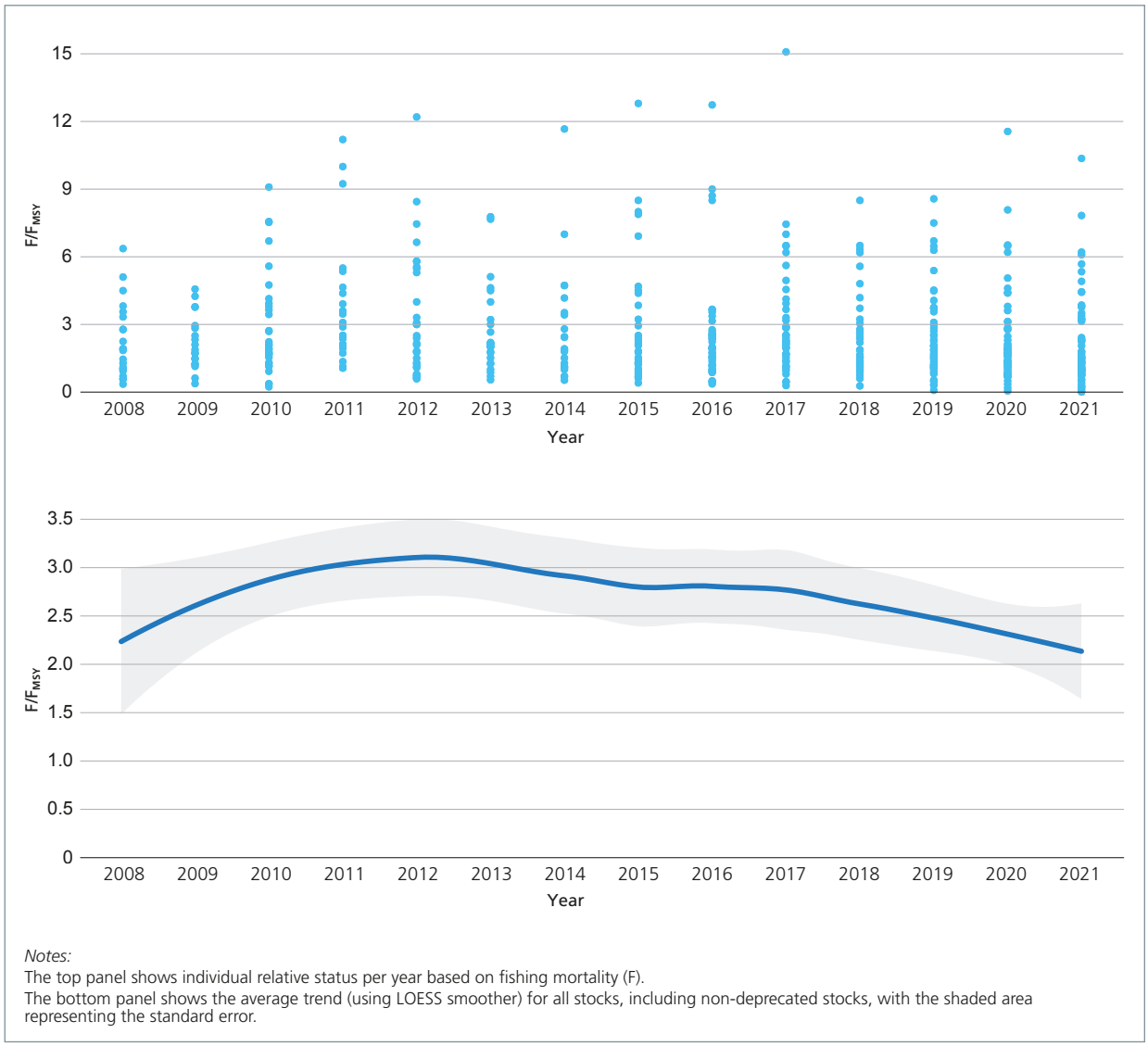


FIGURE 17. Exploitation ratios (F/F_{MSY}) of all species and management units in the GFCM area of application, 2008–2021

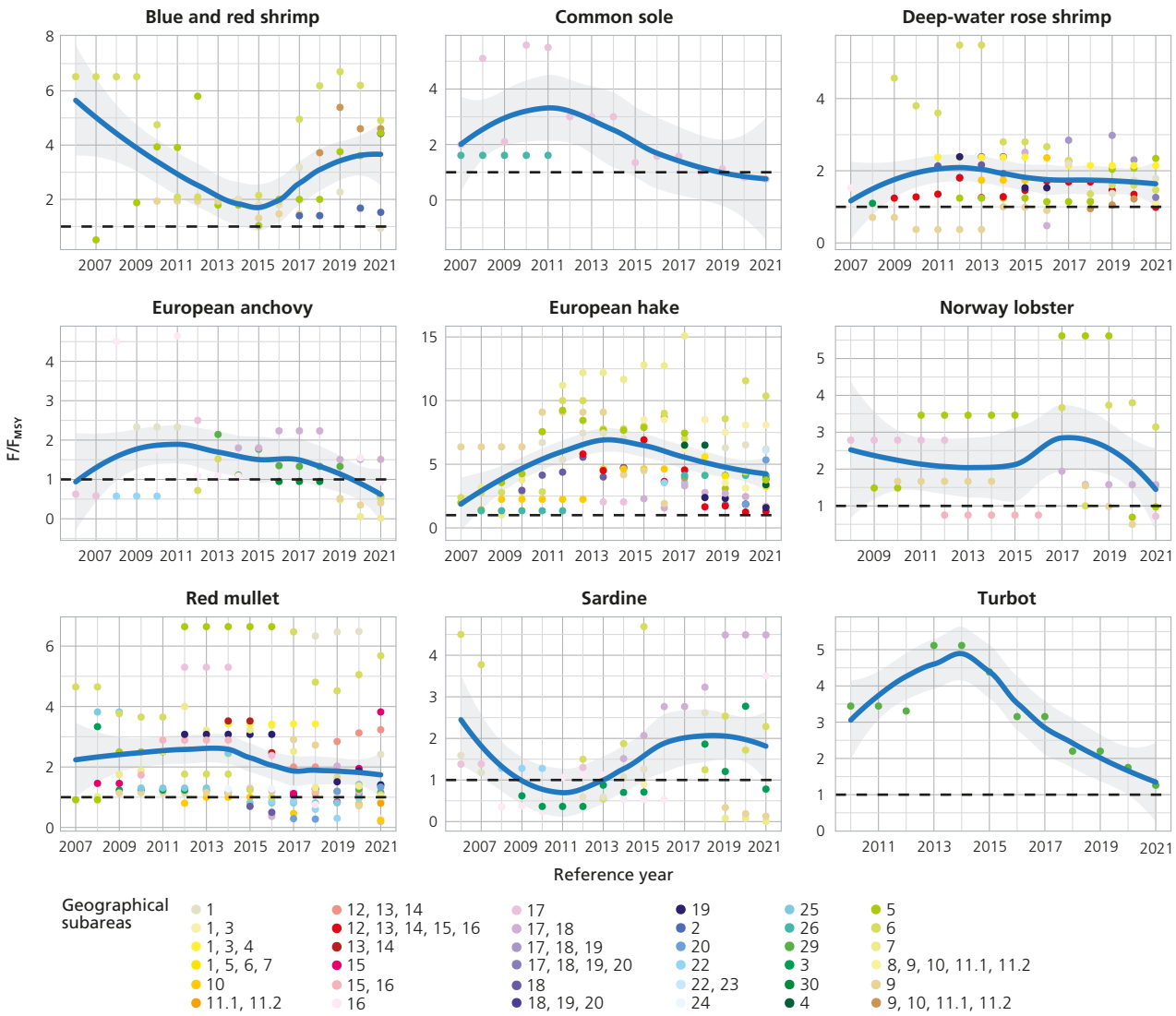


Notes:
The top panel shows individual relative status per year based on fishing mortality (F).
The bottom panel shows the average trend (using LOESS smoother) for all stocks, including non-deprecated stocks, with the shaded area representing the standard error.

STATUS AND TRENDS OF PRIORITY SPECIES

All priority species with enough information to evaluate trends on their status show improvements in fishing pressure (Figure 18) compared to *The State of Mediterranean and the Black Sea Fisheries 2022* (FAO, 2022a). However, an overall average of sustainable exploitation across assessed stocks emerges for only European anchovy (*Engraulis encrasicolus*) and common sole (*Solea solea*), this latter experiencing an additional 2 percent reduction in fishing pressure since 2020. Average values of F/FMSY are approaching sustainable exploitation for Black Sea turbot (*Scophthalmus maximus*), experiencing an additional 11 percent reduction in fishing pressure since 2020, as well as for Norway lobster (*Nephrops norvegicus*) and red mullet (*Mullus barbatus*) (Figure 18). European hake (*Merluccius merluccius*) continues to slowly improve, with a stable average overexploitation ratio and a reduction in the variability surrounding it, probably due to the combined effects of a reduction in fishing mortality and the harmonization of stock assessment models used to provide advice (Figure 18). Fishing pressure on blue and red shrimp appears to have halted its increasing trend, while the pressure exerted on deep-water rose shrimp (*Parapenaeus longirostris*) remains stable at nearly twice what is considered sustainable (Figure 18). European anchovy shows a generally decreasing exploitation ratio, driven by low exploitation ratios in the western Mediterranean, while the exploitation ratios of sardine (*Sardina pilchardus*) across the Mediterranean, despite being targeted by the same fleets as anchovy, are still characterized by high variation, on average twice the level of maximum sustainable yield (Figure 18). These results highlight the differing responses of the two species to the same level of fishing effort.

FIGURE 18. Trends in the exploitation ratios (F/F_{MSY}) of select priority species through 2021

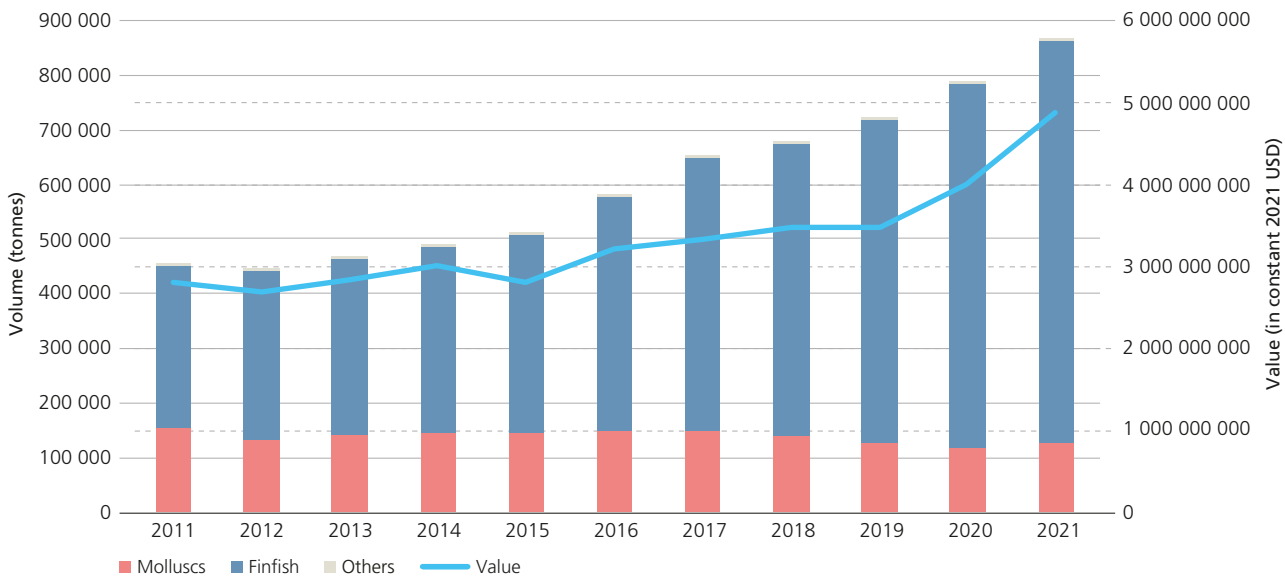


Notes:
Trends are shown using LOESS smoother. The shaded area represents the standard error, and the dashed line represents the exploitation ratio $F/F_{MSY} = 1$. Non-deprecated stocks have been considered in order to build the trend.

6. Aquaculture production

n 2021, total aquaculture production in countries bordering the Mediterranean and the Black Sea reached 3 299 000 tonnes, bringing in USD 10.8 billion worth of revenue (FAO, 2023). The bulk of the production comes from freshwater aquaculture, which represents over 70 percent of the total production in terms of volume, followed by marine production (24 percent) and brackish water production (6 percent). The largest producer among Mediterranean and Black Sea countries is Egypt, accounting for 47.8 percent of the total production in terms of volume (over 1 576 000 tonnes), and the main species reared is Nile tilapia (*Oreochromis niloticus*), with production exceeding 964 000 tonnes (29.2 percent of the total production). The rest of the analysis in this chapter refers only to Mediterranean and Black Sea marine and brackish water aquaculture.

FIGURE 19. Total annual volume and revenue of aquaculture production in the Mediterranean and the Black Sea, 2011–2021

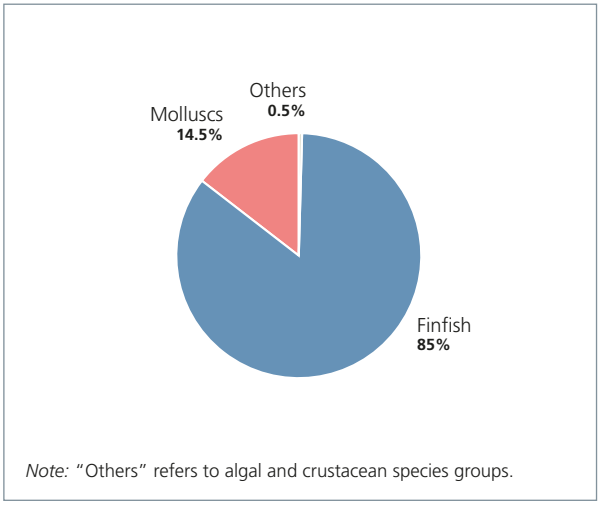


Note: "Others" refers to algal and crustacean species groups.

MARINE AND BRACKISH WATER AQUACULTURE PRODUCTION

Marine and brackish water aquaculture production in the Mediterranean and the Black Sea showed an increasing trend from 2011 to 2021, with a 91.3 percent increase in terms of volume (from more than 455 000 tonnes to over 870 000 tonnes) and a 74.5 percent increase in terms of value (from about USD 2.8 billion to over USD 4.9 billion) (Figure 19). This growth is mainly due to the expansion of finfish aquaculture from over 299 000 tonnes in 2011 to 738 000 tonnes in 2021. In contrast, mollusc production, which represented nearly 14.5 percent of the total production in 2021 (Figure 20), showed a slightly declining trend from 2011 to 2021. The average annual mollusc production over this period was 138 000 tonnes, ranging from a maximum of more than 153 000 tonnes in 2011 to a minimum of about 119 000 tonnes in 2020. Production of crustaceans in 2021 accounted for 0.5 percent of total production, reaching over 3 600 tonnes. Meanwhile, over 114 tonnes of algae were cultivated in 2021, representing 0.01 percent of the total production.

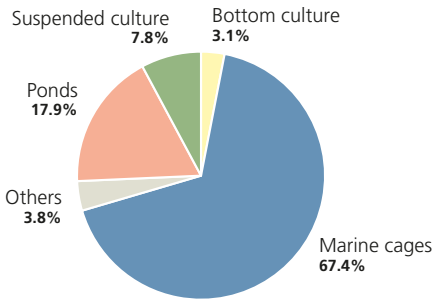
FIGURE 20. Relative contributions of species groups to total aquaculture production in the Mediterranean and the Black Sea, 2021



Note: "Others" refers to algal and crustacean species groups.

The major production method used is marine cages, with production in these structures accounting for 67.4 percent of the total volume in Mediterranean and Black Sea countries over 2020–2021 (Figure 21). Pond and suspended culture are other methods with widespread use in the region, accounting for 17.9 percent and 7.8 percent of total production, respectively. All three of these methods together represent over 93 percent of the region's total production. Other

FIGURE 21. Relative contributions of production methods to total aquaculture production in the Mediterranean and the Black Sea, 2020–2021



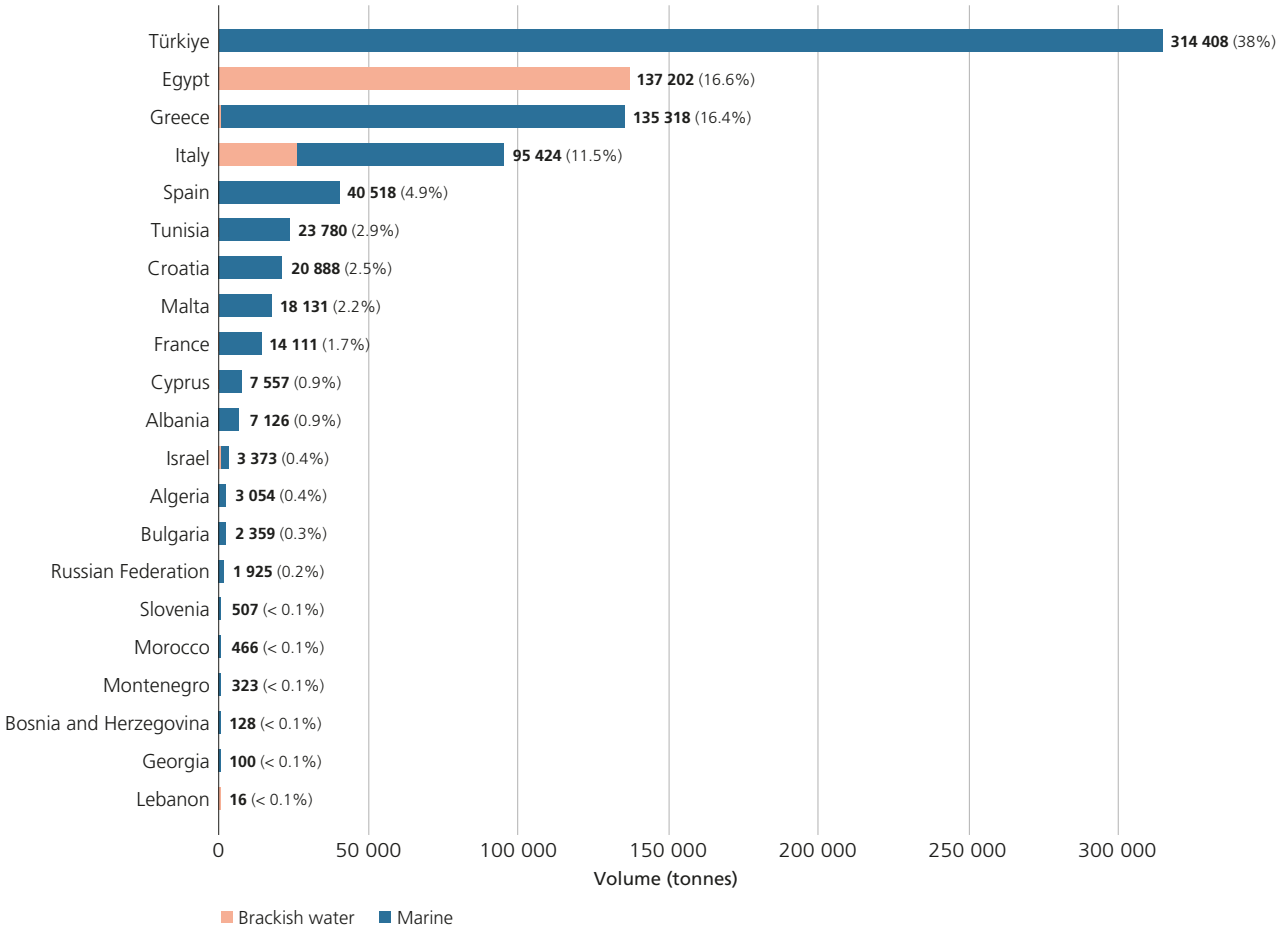
Note: "Others" refers to dams, reservoirs, barrages, lagoons, raceways and tanks.

relevant production methods, ranked from highest to lowest use, include bottom culture, dams, reservoirs, barrages, lagoons, raceways and tanks (GFCM, 2023b).

AQUACULTURE PRODUCTION BY COUNTRY

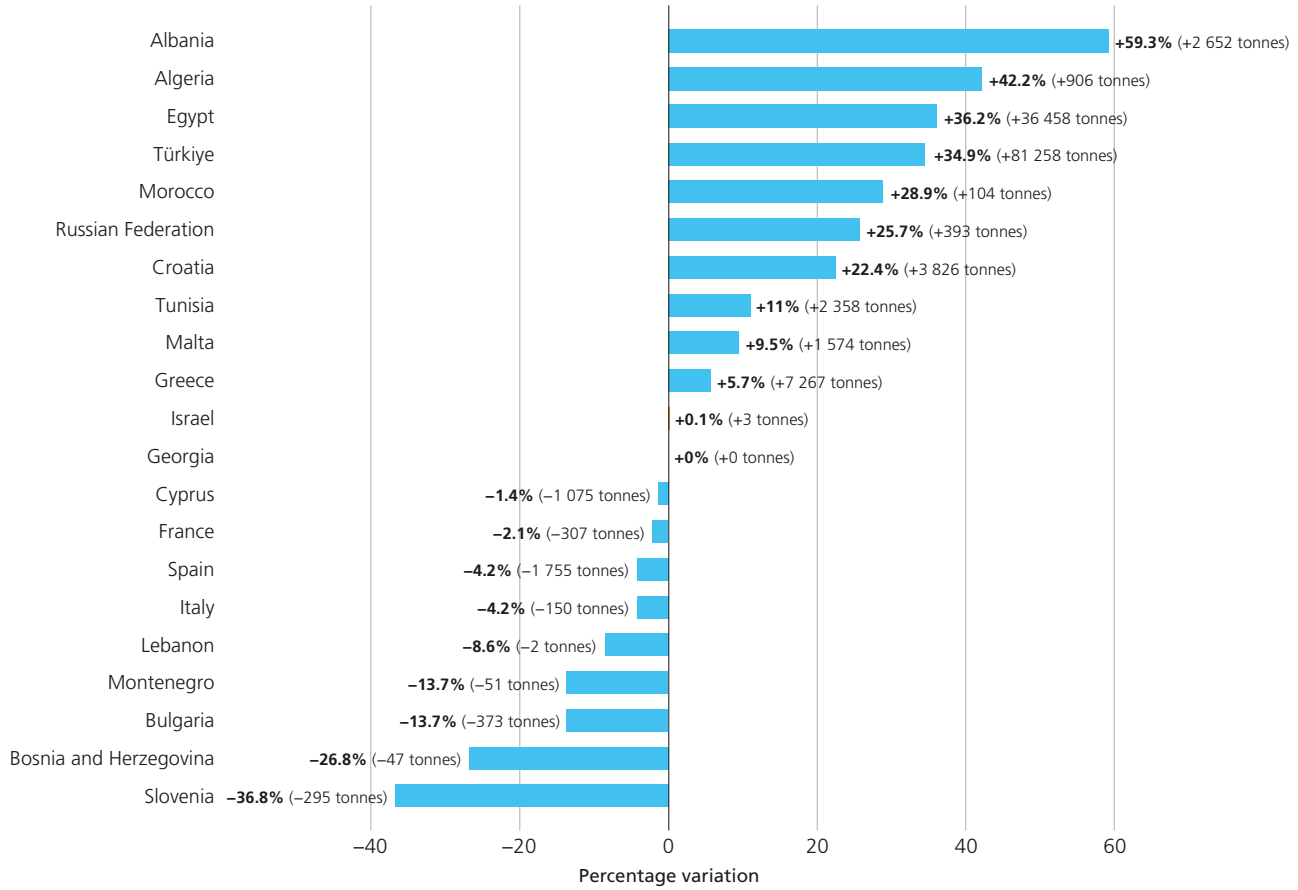
Average annual aquaculture production over 2020–2021 in the Mediterranean and the Black Sea is clearly led by Türkiye, which accounts for 38 percent of the total production in terms of volume (314 408 tonnes) (Figure 22). The second highest producer is Egypt (137 202 tonnes, 16.6 percent of the total volume), followed by Greece (135 318 tonnes, 16.4 percent), Italy (95 424 tonnes, 11.5 percent), Spain (40 518 tonnes, 4.9 percent),

FIGURE 22. Annual aquaculture production by Mediterranean and Black Sea country, 2020–2021 averages



Note: Percentages indicate the relative contributions of countries to total aquaculture production across Mediterranean and Black Sea countries over 2020–2021.

FIGURE 23. Percentage variation between average annual aquaculture production over 2018–2019 and average annual aquaculture production over 2020–2021, by Mediterranean and Black Sea country



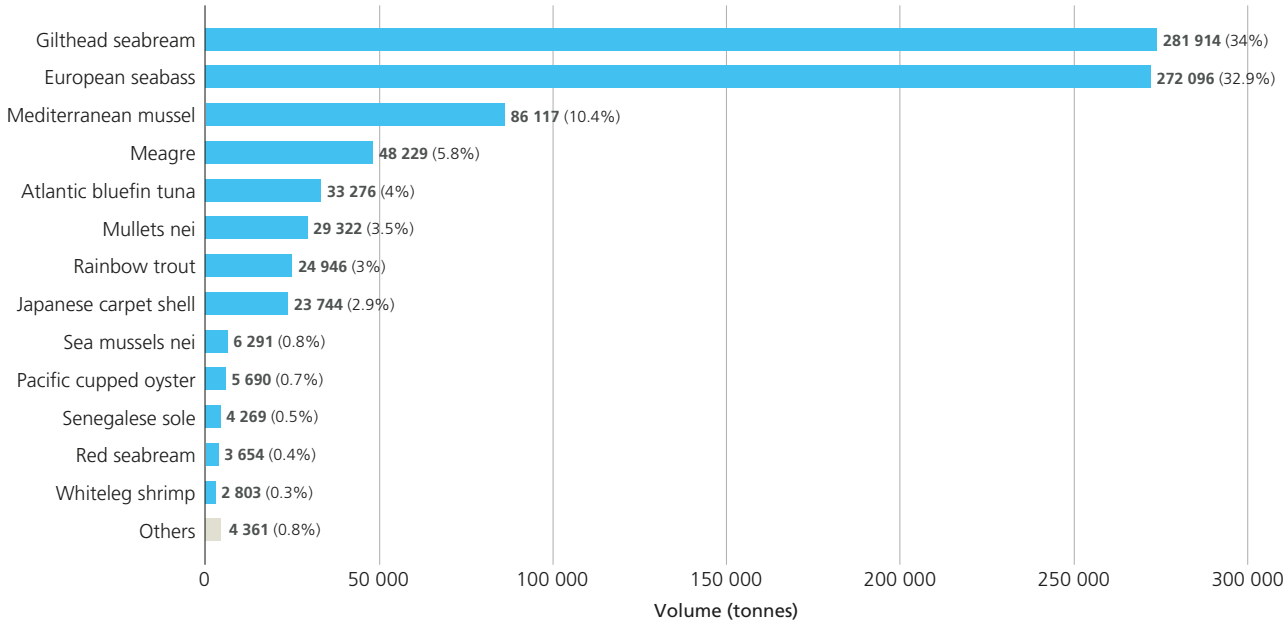
Tunisia (23 780 tonnes, 2.9 percent), Croatia (20 888 tonnes, 2.5 percent) and Malta (18 131 tonnes, 2.2 percent). Eight countries therefore represent 95 percent of the total aquaculture production in the region.

In terms of total production by country, major growth rates between 2018–2019 and 2020–2021 were recorded in Albania, Algeria, Egypt and Türkiye, with respective increases in production of 59.3 percent (+2 652 tonnes), 42.2 percent (+906 tonnes), 36.2 percent (+36 458 tonnes) and 34.9 percent (+81 258 tonnes). By contrast, the largest percent decreases occurred in Slovenia, Bosnia and Herzegovina, Bulgaria and Montenegro, showing respective declines of 36.8 percent (–295 tonnes), 26.8 percent (–47 tonnes), 13.7 percent (–373 tonnes) and 13.7 percent (–51 tonnes) (Figure 23).

AQUACULTURE PRODUCTION BY MAIN SPECIES REARED

The average annual aquaculture production in Mediterranean and Black Sea countries by species reared over 2020–2021 is shown in Figure 24. Thirteen species out of the 47 total cultivated in the region account for almost 99.5 percent of the total production by volume over 2020–2021. The main species reared is gilthead seabream (*Sparus aurata*), with production reaching 281 914 tonnes (34.1 percent of the total production), followed by European seabass (*Dicentrarchus labrax*) (272 096 tonnes, 33 percent), Mediterranean mussel (*Mytilus galloprovincialis*) (86 117 tonnes, 10.4 percent), meagre (*Argyrosomus regius*) (48 229 tonnes, 5.8 percent), Atlantic bluefin tuna (*Thunnus thynnus*) (33 276 tonnes, 4 percent) and mullets nei (Mugilidae) (29 322 tonnes, 3.5 percent).

FIGURE 24. Annual aquaculture production across Mediterranean and Black Sea countries by main species reared, 2020–2021 averages

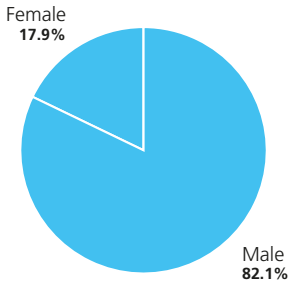


Note: Percentages indicate the relative contributions of main species reared to total aquaculture production across Mediterranean and Black Sea countries over 2020–2021.

AQUACULTURE SOCIOECONOMIC DATA

A survey was conducted in February 2023 in order to collect socioeconomic data on the region's aquaculture sector, including on direct employment in 2021. Fourteen countries transmitted their data[6] (as of 25 July 2023), and the total number of jobs reported reached 97 483 in 2021. Egypt reported the most jobs of any country (over 83 percent of regional representation), followed by France (5.9 percent), Spain (3.0 percent), Türkiye (2.9 percent) and Italy (1.3 percent). Thirteen of the 14 countries transmitted gender-disaggregated data, and the total average shows that female employment accounts for only 17.9 percent of direct jobs in these countries (Figure 25). Countries employing a higher female proportion of their total employment are France (37.1 percent of total jobs), Albania (27.4 percent), Spain (26.5 percent) and Morocco (26.4 percent),

FIGURE 25. Percentage by gender of direct employment in the aquaculture sector in Mediterranean and Black Sea countries transmitting gender-disaggregated data, 2021



Note: The thirteen countries providing the data combined in this figure are Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Greece, Italy, Montenegro, Morocco, Spain and Türkiye.

while countries employing fewer women are Algeria (2.3 percent), Türkiye (7.23 percent), Italy (9.1 percent) and Tunisia (10 percent).

[6] The following countries were not included in the estimates presented in this chapter due to missing data or the absence of marine and brackish water production in the Mediterranean and Black Sea basins: Bosnia and Herzegovina, Georgia, Israel, Lebanon, Libya, Malta, Romania, the Russian Federation, Slovenia, the Syrian Arab Republic and Ukraine.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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 State of Mediterranean and Black Sea Fisheries 2022* (FAO, 2022a), focusing on the most relevant multiannual management plans and measures for priority species. The spatial management measures covered include recent decisions regarding fisheries restricted areas (FRAs), such as the establishment of a set of minimum standards for FRAs in the GFCM area of application. Ongoing and newly launched GFCM research programmes are also presented, as well as pilot studies and projects, including those on recreational fisheries and jellyfish. These activities represent important tools 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 and the consolidation of existing transitional measures into long-term ones. The information presented in this chapter derives from the outcomes of relevant GFCM expert meetings held over 2021–2022 and from the Compendium of GFCM decisions (GFCM, 2023c).

MULTIANNUAL MANAGEMENT PLANS AND MANAGEMENT MEASURES

Over the past ten years, the GFCM has adopted ten adaptive multiannual management plans. While some of these plans outline specific long-term measures, e.g. for the protection of Black Sea turbot (*Scophthalmus maximus*), as of 2022 most management plans set out to progress in a step-wise manner with a transitional phase while working towards the establishment of long-term measures in an adaptive manner. Three additional recommendations set management measures for European sprat (*Sprattus sprattus*) and piked dogfish (*Squalus acanthias*) in the Black Sea and for anchored fish aggregating devices for common dolphinfish (*Coryphaena hippurus*) in the Mediterranean.

In the past year, since the release of *The State of Mediterranean and Black Sea Fisheries 2022* (FAO, 2022a), four of the ten active management plans were amended or updated. These updates consist of:

- new options for the closure period of European eel (*Anguilla anguilla*) fisheries in the Mediterranean (six consecutive months or three consecutive months from January to March plus another three months at the discretion of each CPC), along with a ban on recreational fisheries;[7]
- extension of the deadlines for the transitional period of the catch documentation scheme and the research programme on red coral (*Corallium rubrum*) in the Mediterranean, along with compulsory recording of the diameter of red coral colonies;[8]
- rollover of the total allowable catch and quotas for turbot in the Black Sea by an extra year;[9] and
- adaptation for application in 2023[10] of the effort regime for demersal fisheries in the Adriatic Sea.

During the same period, five new management plans were adopted, either replacing previous ones (repealing existing recommendations) or turning existing management measures into a structured multiannual management plan, as in the case of fisheries targeting deep-water red shrimp – giant red shrimp (*Aristaeomorpha foliacea*) and blue and red shrimp (*Aristeus antennatus*) – in the Strait of Sicily. These five plans all foresee transitional periods of three years (2023–2025), including details on transitional measures and the work required towards identifying and establishing long-term management measures applicable over the period 2026–2030. These transitional periods can be summarized as follows:

- **Blackspot seabream in the Alboran Sea**[11] The transitional period foresees catch limits and a freeze in fishing capacity/effort while working towards an updated minimum conservation reference size and the determination of spatial measures protecting essential fish habitats (EFHs) for this species.
- **Demersal stocks in the Strait of Sicily**[12] The transitional period foresees a freeze in fishing capacity/effort, an effort regime for authorized vessels targeting European hake (*Merluccius merluccius*) and catch limits for deep-water rose shrimp (*Parapenaeus longirostris*), as well as the rollover of existing FRAs accompanied by a permanent inspection scheme, while working towards the identification of new FRAs, the possible inclusion of additional key species – red mullet (*Mullus barbatus*), striped red mullet (*Mullus surmuletus*) and Norway lobster (*Nephrops norvegicus*) – and gear types – longlines, gillnets and trammel nets – and the determination of new minimum conservation reference sizes for key species.

[7] Recommendation GFCM/45/2022/1 on a multiannual management plan for European eel in the Mediterranean Sea, amending Recommendation GFCM/42/2018/1

[8] Recommendation GFCM/45/2022/2 on a management plan for the sustainable exploitation of red coral in the Mediterranean Sea, amending Recommendation GFCM/43/2019/4

[9] Recommendation GFCM/45/2022/9 on a multiannual management plan for turbot fisheries in the Black Sea (geographical subarea 29), amending Recommendation GFCM/43/2019/3

[10] Recommendation GFCM/45/2022/8 on the implementation of a fishing effort regime for key demersal stocks in the Adriatic Sea (geographical subareas 17 and 18) in 2023, stemming from Recommendation GFCM/43/2019/5

[11] Recommendation GFCM/45/2022/3 on a multiannual management plan for the sustainable exploitation of blackspot seabream in the Alboran Sea (geographical subareas 1 to 3), repealing Recommendations GFCM/44/2021/4, GFCM/43/2019/2 and GFCM/41/2017/2

[12] Recommendation GFCM/45/2022/4 on a multiannual management plan for the sustainable exploitation of demersal stocks in the Strait of Sicily (geographical subareas 12 to 16), repealing Recommendations GFCM/44/2021/12 and GFCM/42/2018/5

- **Deep-water red shrimp fisheries in the Strait of Sicily,[13] the Ionian Sea[14] and the Levant Sea**
  The transitional period foresees a freeze in fishing capacity/effort, transitional catch limits and a 30-day temporal closure between March and September, accompanied by a permanent inspection scheme, while working towards the determination of the fishing footprint, new spatial measures and minimum conservation reference sizes for the two species.

SPATIAL MANAGEMENT MEASURES AND RELATED ACTIVITIES

To date, ten FRAs have been established by the GFCM to protect vulnerable marine ecosystems (VMEs) or sensitive habitats from potentially significant adverse impacts (VME-FRAs) and to enhance the productivity of marine living resources by protecting essential fish habitats (EFH-FRAs).

Fisheries restricted areas are recognized as important management tools, but their effectiveness depends on sound principles for their establishment and monitoring. To implement such principles, the GFCM adopted in 2022 a recommendation establishing a set of minimum standards for FRAs in the GFCM area of application,[15] based on the so-called FRAs toolkit developed in 2021 and described in *The State of Mediterranean and Black Sea Fisheries 2022* (FAO, 2022a). This recommendation has the aim of increasing the coherence of the network of FRAs, harmonizing the management measures applied across subregions, levelling the playing field among fishers and helping to improve the conservation status of stocks and ecosystems. It is applicable to all newly established FRAs within the GFCM area of application and to existing ones at the discretion of the GFCM Scientific Advisory Committee on Fisheries. Thus, all new FRAs shall consist of two types of zones with specific management measures to be discussed in consultation with stakeholders: Zone A, a permanent closure zone; and Zone B, a temporary closure zone (or buffer area). In addition, the recommendation foresees that:

- each FRA is accompanied by a scientific monitoring plan, following a common standardized protocol specific to the FRA typology in question (VME-FRA or EFH-FRA);
- information on all vessels authorized to fish in Zone B of the FRA is recorded and made publicly available;
- information on fishing activities, as well as data on the catch of key species and the incidental catch, release and discarding of sensitive species (listed in Annex II or Annex III of the Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean of the Barcelona Convention) (UNEP/MAP and SPA/RAC, 2023) are recorded, in line with international standards and the data reporting requirements of relevant GFCM recommendations; and
- any other additional measures (e.g. 5 percent coverage by onboard observers or remote electronic monitoring) are taken to improve data collection in view of the scientific monitoring of key species.

These measures are foreseen to be complemented by a number of important monitoring, control and surveillance measures, including lists of authorized vessels for both zone types and remote electronic monitoring. The implementation of this recommendation will allow FRAs to be truly adaptive management tools in the future.

With a view to advancing on the establishment of a FRA for the protection of deep-sea VMEs and EFHs in the Cabliers coral mounds (Alboran Sea), the GFCM also adopted a resolution outlining a roadmap towards this aim.[16] This decision lays the groundwork for the future establishment of a FRA through the implementation of scientific surveys and monitoring towards assessing the exact geographical delimitation and zoning of the area, in coordination with all CPCs involved.

[13] Recommendation GFCM/45/2022/5 on a multiannual management plan for the sustainable exploitation of giant red shrimp and blue and red shrimp stocks in the Strait of Sicily (geographical subareas 12 to 16), repealing Recommendations GFCM/44/2021/7 and GFCM/43/2019/6

[14] Recommendation GFCM/45/2022/6 on a multiannual management plan for the sustainable exploitation of giant red shrimp and blue and red shrimp stocks in the Ionian Sea (geographical subareas 19 to 21), repealing Recommendations GFCM/44/2021/8 and GFCM/42/2018/4

[15] Recommendation GFCM/45/2022/11 on the establishment of a set of minimum standards for fisheries restricted areas in the GFCM area of application

[16] Resolution GFCM/45/2022/4 on the launch of a roadmap for the establishment of a fisheries restricted area in the Cabliers coral mounds in the Alboran Sea with a view to adopting adequate protection and management measures

RECREATIONAL FISHERIES

In light of the socioeconomic relevance of recreational fisheries and their potential impacts on several priority commercial species in overexploitation status, and since recreational fisheries catch cannot be commercialized, the need to continue monitoring these fisheries has been recognized as crucial towards facilitating their management and avoiding negative impacts, including on commercial fisheries. In this regard, the GFCM adopted in 2022 a recommendation establishing a set of minimum rules for sustainable recreational fisheries in the Mediterranean Sea,[17] which also includes provisions for the development of a research programme (see below). The minimum standards established by this decision include conservation measures (prohibitions and defining the practices and fishing gear types allowed in recreational fisheries), control and monitoring measures (licences, catch declaration and reporting, control and enforcement) and provisions related to data collection and reporting and scientific assessment, as well as guidelines for participatory governance and the promotion of best practices at both the regional and subregional levels.

GFCM RESEARCH PROGRAMMES AND PILOT STUDIES

Research programmes share the common aim of improving the scientific basis for the provision of advice on existing and potential management measures. They comprise dedicated actions towards increasing the quality and quantity of information on fishery resources and addressing identified knowledge gaps and shortcomings in relevant scientific or technical advice. Since the start of the first research programme on rapa whelk (*Rapana venosa*) in 2019, the GFCM has launched six research programmes and three subregionally focused pilot projects and studies, with more under development.

In 2022, the existing recommendation for a research programme on rapa whelk fisheries in the Black Sea was extended, with the aim of completing the work undertaken on the socioeconomics of the fishery and the development of management strategy evaluation towards providing scientific advice on potential management measures in 2023.[18] In the same year, an additional two decisions were adopted towards the creation of two research programmes. The first comes out of the provisions of Recommendation GFCM/45/2022/12,[17] for which a research programme on recreational fisheries is being developed. Second, a resolution establishing a research programme on jellyfish in the western Mediterranean[19] was adopted with the aim of improving scientific knowledge on jellyfish and their interactions with other taxa, the marine ecosystem and fisheries in the Alboran Sea, in order to mitigate the adverse effects of these proliferating species on the fishing, aquaculture and tourism industries. A methodology is expected to be developed that could serve as a model for replication in other subregions in the future.

Finally, recognizing the fast spread of non-indigenous species in the Mediterranean and the eastern Mediterranean as a hotspot for these species, the GFCM agreed on launching a pilot study on non-indigenous species in the eastern Mediterranean in order to consolidate an integrated monitoring platform. The pilot study is being developed under the general framework of an ecosystem approach to fisheries, with the crucial objective of contributing to future management in a quick and adaptive manner, fully involving fishers and relevant stakeholders.

[17] Recommendation GFCM/45/2022/12 on the establishment of a set of minimum rules for sustainable recreational fisheries in the Mediterranean Sea

[18] Recommendation GFCM/45/2022/10 on a regional research programme for rapa whelk fisheries in the Black Sea (geographical subarea 29), amending Recommendation GFCM/42/2018/9

[19] Resolution GFCM/45/2022/2 on a research programme on jellyfish in the western Mediterranean (geographical subareas 1 to 3)

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The State of Mediterranean and Black Sea Fisheries 2023

SPECIAL EDITION

This 2023 special edition of the GFCM's flagship publication, *The State of Mediterranean and Black Sea Fisheries*, updates statistics and figures on the status and management of fisheries in the region and includes, for the first time, an overview of regional indicators on the aquaculture sector in Mediterranean and Black Sea countries. It aims to deliver useful and reliable data to a wide audience as an essential source of information on fisheries and aquaculture in the region and a key tool to support decision-making and monitor progress towards the goals set by the GFCM.

The fifth instalment of its series, this publication covers topics of regional importance in the fisheries and aquaculture sectors over the course of seven chapters. Fleet status and capture fisheries production are the focus of the first two chapters, which include figures on fishing capacity and landings by country and fleet segment. Chapter three captures the human dimension behind the region's fisheries through socioeconomic data on revenue and employment. In chapter four, information on discards is updated and categorized for the main fishing fleets in each GFCM subregion, along with details on the species that make up this important component of the catch. Chapter five reviews the status of fisheries resources, especially regional trends and trends in priority species, while chapter seven summarizes relevant existing and new adopted measures towards the sustainability of key fisheries and the protection of vulnerable ecosystems. Aquaculture is included in this edition for the first time, described in terms of volume and socioeconomic indicators in chapter six.

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