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By

Paolo Carpentieri
Fishery Resources Monitoring Specialist
General Fisheries Commission for the Mediterranean
Food and Agriculture Organization of the United Nations
Rome, Italy

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Preparation of this document

This document was prepared by the General Fisheries Commission for the Mediterranean (GFCM) of the Food and Agriculture Organization of the United Nations (FAO) as a response to priorities identified by Mediterranean and Black Sea countries in the context of international commitments and regional strategies. This includes the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries (mid-term strategy) and in particular its Target 4, "Minimize and mitigate unwanted interactions between fisheries and the marine ecosystems and environment". This document contributes to the objective set in the mid-term strategy of reducing bycatch rates as a way to safeguard the profitability and sustainability of fisheries through a harmonized framework to increase knowledge on discards and support data collection in the GFCM area of application. It was produced ahead of the implementation of a GFCM discards monitoring programme in Albania, Algeria, Egypt, Lebanon, Montenegro, Morocco, Tunisia, Turkey and Ukraine between 2019 and 2020, whose results will provide a clear overview of the phenomenon and support the identification of appropriate management measures at both the subregional and regional levels.

Paolo Carpentieri, GFCM Fishery Resources Monitoring Specialist, elaborated the methodology and was responsible for the general coordination and compilation of this document. He relied on important baseline information gathered by the GFCM throughout the development of its Data Collection Reference Framework (DCRF)[1], during the implementation of scientific surveys-at-sea or in other contexts such as the European Union (EU) Data Collection Framework (DCF). The multiple-step collaborative approach adopted in his analyses allowed for the identification of flexible, relevant methods for Mediterranean and Black Sea fisheries. This work also builds upon the methodologies developed in similar concurrent data collection programmes, such as the programme on incidental catches of vulnerable species carried out by the GFCM in collaboration with a number of partner organizations operating in the Mediterranean. The document was submitted for review to the national focal points involved in the implementation of the GFCM discards monitoring programme, namely: Ahmed Inal (Algeria), Imad Lahoud (Lebanon), Ana Pešić (Montenegro), Sana El Arraf (Morocco), Nader Ben Hadjamida (Tunisia), Hüseyin Özbilgin (Turkey) and Serhii Snihirov (Ukraine), who gave their technical inputs on the methodology and helped improve the templates for data collection based on their field experience. The Regional Coordination Group for the Mediterranean and Black Sea (RCGMed&BS) of the European Commission (EC) also contributed additional information based on ongoing EU discards collection programmes. This led to the establishment of appropriate coordination mechanisms and to the alignment of data collection methodologies to compare results across the different countries and areas. Finally, the work was submitted to the GFCM Scientific Advisory Committee on Fisheries (SAC) and the GFCM Working Group on the Black Sea (WGBS) who endorsed it and provided feedback for its finalization. The editing, graphics, layout and publishing were coordinated by Dominique Bourdenet, GFCM Scientific Editor, with the assistance of Julia Pierraccini, GFCM Language and Communications Specialist, and Lauriane Palopoli, GFCM Editing/Communications Intern. Barbara Hall served as language editor, and Chorouk Benkabbour managed the graphic design and layout.

This document was produced with the financial support of the EU. The views expressed herein can in no way be taken to reflect the official opinion of the EU.

[1] The DCRF is updated on a regular basis, please check the DCRF section on the GFCM website for the latest version

Abstract

Discards, the part of the catch that is not retained on board, which may include target species or any other commercial and non-commercial species that are returned at sea dead or alive, is a global issue. According to the latest figures, there are an estimated 9.1 million tonnes of discarded fish per year. Discards usually result in a reduction of harvesting opportunities and may have negative consequences on the stocks, ecosystems and the marine environment. Information on total catch that includes discarding rates is therefore crucial for an efficient management framework that aims at sustainable and economically viable fisheries.

In the Mediterranean and the Black Sea, studies on discards only cover a small portion of the total fishing activities, and discard rates are often poorly estimated or totally unknown. Information is lacking for many types of fishing gear, countries and GFCM subregions, and most available studies only cover relatively short periods and small areas. Discards therefore represent a major source of uncertainty about the actual fishing mortality rates of stocks.

These knowledge gaps highlight the need to expand discard monitoring programmes and standardize practices. This prompted the GFCM Membership to commit to bring the discarding issue back to the forefront, within Target 4 of the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries. This commitment recognizes the important impacts of this practice as well as the need to have better information in order to assess it appropriately.

In the GFCM area, there is also a lack of standard protocols for sampling at sea covering different fisheries due to the significant differences in fisheries activities, volume of catch and diversity of catch composition, resulting in a considerable diversity in sampling practices. This makes it difficult to reach evidence-based regional approaches and solutions.

Taking into account relevant characteristics and specificities of the Mediterranean and Black Sea, the methodology presented in the document aims to support the development and implementation of efficient and harmonized discard monitoring systems across the Mediterranean and the Black Sea namely by: (i) providing a minimum set of standards for the collection of discard data, consistent with GFCM requirements and applicable in countries without such programmes in place; (ii) standardizing the data to be collected, including the forms to be used; and (iii) collecting fisheries data that can be used for stock assessment and management purposes. This is based on three approaches for the sampling of discards: (i) monitoring at-sea of commercial catches (observers on board); (ii) direct discussions with fishers at landing points (questionnaires); and (iii) self-sampling, i.e. information provided by the fishers themselves in order to have data that are as representative as possible of the entire fleet segment, especially if resources or conditions cannot ensure a relatively high number of observations. The methodology also allows to collect relevant complementary information on incidental catches of vulnerable species, marine litter and non-indigenous species.

Contents

Tables

Figures

Boxes

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Acronyms

CL	Carapace length
CV	Coefficient of variation
DCF	Data Collection Framework (EU)
DCRF	Data Collection Reference Framework (GFCM)
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FL	Fork length
GFCM	General Fisheries Commission for the Mediterranean
GSA	Geographical subarea (GFCM)
GT	Gross tonnage
IUCN	International Union for Conservation of Nature
LOA	Length overall
ML	Mantle length
SAC	Scientific Advisory Committee on Fisheries
SL	Standard length
SPA/BD	Specially Protected Areas and Biodiversity
TL	Total length
VME	Vulnerable marine ecosystem
WGBS	Working Group on the Black Sea

Definitions

For the purpose of this document, the following definitions have been used (adapted from GFCM, 2018a):

Active vessel:	In terms of its operational status, a vessel is considered active when it executes at least one fishing operation during the reference year in the GFCM area of application.
Bycatch:	The 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), non-commercial species as well as to the incidental catch of endangered, vulnerable or rare species (e.g. sea turtles, sharks, marine mammals).
Catch:	The amount of marine biological resources that are caught by the fishing gear and reach the deck of the fishing vessel. This includes individuals of the target species, which are usually kept on board and retained, as well as bycatch, which refers to species with or without commercial value that are not targeted by the fishery.
Discards:	The part of the catch that is not retained on board and is returned at sea, dead or alive. It may include target species or any other species (both commercial and non-commercial) discarded at sea.
Fishing operation:	Any single action carried out during a fishing trip, whether or not a catch was made; this includes, inter alia, towing a trawl net, setting a line and hauling pots and traps.
Fleet segment:	The combination of a group of fishing vessels of the same size category and using the same gear type for more than 50 percent of the time at sea during a year.
Fishing trip:	In the simplest cases, a fishing vessel leaves the port, steams to the fishing grounds, fishes for a certain time and returns to the port where its catch is landed. The combination of these events is called a "fishing trip" (Sparre, 2000). Generally, in the Mediterranean and the Black Sea, a 24-hour period (i.e. a fishing day), irrespective of the calendar day, is often used as a time unit. During a fishing trip, a fishing vessel may carry out different fishing operations.
Fishing vessel:	Any vessel used or intended to be used for the commercial exploitation of marine living resources.
Landing:	The part of the catch that is retained on board and brought ashore.
Non-indigenous species:	Any species introduced – either intentionally or unintentionally – outside its natural past or present distribution. These species are also known as exotic or alien species. Their establishment can modify ecosystems, biodiversity and fishing behaviour, and can have (negative and/or positive) social and economic impacts.
Vulnerable species:	A taxon is considered vulnerable when facing a high risk of extinction in the wild in the medium-term future. For the purpose of this document, the lists of seabirds, sea turtles, marine mammals and shark species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (the Barcelona Convention), together with elasmobranch species included in the IUCN Red List of Threatened Species, and benthic species pertaining to vulnerable marine ecosystems (VMEs) have been used.

1. INTRODUCTION

Discarding occurs because most fishing gear and fishing practices are not selective enough for the targeted species and size, and because target species also inhabit areas that are occupied by a wide range of other species (Clucas, 1997).

In the Mediterranean and the Black Sea, commercial fisheries discard at least 275 000 tonnes per year (FAO, 2016, 2018; Perez Roda *et al*., 2019). Demersal trawl fisheries produce almost half of these quantities, whereas discard rates for pelagic fisheries, such as pelagic trawls and purse seiners, are generally lower than those for bottom trawls. Information on discards in small-scale fisheries is relatively scarce, but available data (mainly for trammel net and gillnet) show a discard rate lower than for other fisheries. Despite the few available information, there is little guidance on how to conduct discard samplings in order to achieve the required sampling and precision.

The main objective of these guidelines is to develop and implement an efficient and harmonized discard monitoring system in Mediterranean and Black Sea areas, namely by:

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

Data collected through a well-established monitoring programme will be useful to:

- identify and describe the discard behaviour of the main fleet segments (per GFCM subregion, country and geographical subarea [GSA]);
- provide estimates of the total amounts discarded by fleet segment;
- estimate the quantity of the species discarded (e.g. priority, commercial and non-commercial species);
- identify the typology of current fishing practices pertaining to fisheries that lead to discarding (e.g. fishing area, seasonality, carrying capacity of the vessels, market factors);
- incorporate discard estimates in stock assessments;
- provide additional information on the impacts of fisheries on incidental catch of vulnerable species and on non-indigenous species.

These guidelines are based on three types of approaches: (i) sampling of discards through at-sea monitoring of commercial catches (observers on board); (ii) sampling of discards by fishers, so that the collection of discard data is more representative of the whole fleet segment and does not involve too many observers (self-sampling); and (iii) sampling of discards through direct discussions with fishers (questionnaires).

1.1. WHAT ARE DISCARDS?

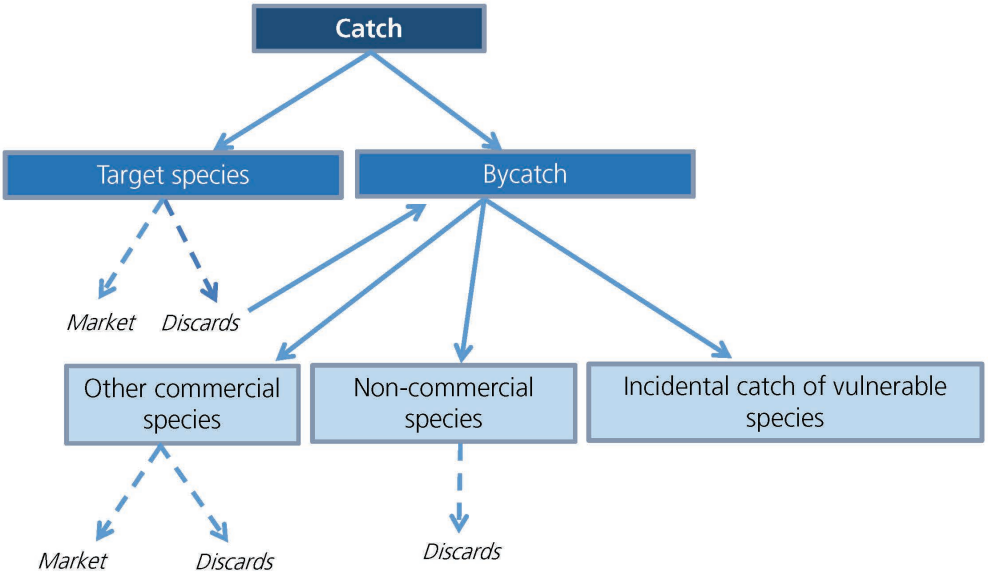
Discards (Figure 1) are considered the part of the catch, including target species or any other species (both commercial and non-commercial), not retained on board and discarded at sea (GFCM, 2018a).

Discarding is due to a variety of reasons: a low commercial value of the species; the small size and/or poor conditions of individuals (e.g. due to prolonged time between capture and landing, damaged by gear or other) (Kelleher, 2005; FAO, 2011); or fisheries management policies (Vestergaard, 1996). Some legislations implicitly or explicitly encourage discarding of fish, molluscs and crustaceans of specimens smaller than the defined minimum landing size (Council Regulation EC 1967/2006) or in case

of a discard ban.[1] In some cases, the lack of space on board can be a factor influencing discards: with a restricted storage capacity, the master of a vessel may prefer to retain only the most valuable species.

Other environmental, biological and behavioural factors play an important role in discarding practices because they influence the composition of the catch (Crowder and Murawski, 1998; Hall *et al.*, 2000; Rochet and Trenkel, 2005). Such factors include: season and area (temporal and/or spatial aggregation of bycatch species or sizes); rare species occurrence; fishers' behaviour (their ability and willingness to avoid bycatch); year-class strength (variable abundance of small, non-marketable individuals); the state of the population (predominance of smaller individuals in exploited populations); and species assemblages (the association between target and bycatch species).

FIGURE 1
Different components of the catch as defined by the GFCM Data Collection Reference Framework (DCRF)



Source: GFCM, 2018a.

1.2. WHY IS DISCARDING A PROBLEM?

Discards of commercial and non-commercial species are a complex and diverse issue. Discards have negative consequences on the environment and the ecosystems (Kennelly, 1995; Hall, 1996). They increase changes in the food chain ecology by generating increased levels of food through dead fish or fish that may not survive after release, altering the relative prey-predator abundance (Garthe *et al.*, 1996; Furness, 2003; Garthe and Scherp, 2003) and causing additional interactions between species (e.g. scavenging organisms on the sea floor and feeding populations of seabirds, marine mammals, sharks) (Votier *et al.*, 2004). In particular, in deep-sea environments where food is scarce, the input of organic matter from discards increases the diversity of benthic communities in localized areas (Jennings and Kaiser, 1998). In contrast, species with a low discard mortality may increase in terms of abundance in areas of extensive fishing (Rogers and Ellis, 2000) and alter relationships in the ecosystem.

[1] See European Commission,"Discarding and the landing obligation". https://ec.europa.eu/fisheries/cfp/fishing_rules/discards_en

The majority of specimens caught and discarded either dead or dying are usually small and sexually immature (Alverson *et al.*, 1994; Evans *et al.*, 1994; CEC, 2002; Davis, 2002). This implies a reduction in the future spawning stock biomass and in the potential for the stock to rebuild, which is currently one of the key parameters in fisheries management. Discards of small specimens also entail a reduction in future harvesting opportunities, which reduces the growth potential of the stock as well as potential yields from the fishery, with obvious economic consequences.

1.3 THE NEED FOR DATA ON DISCARDS

Understanding discarding is of fundamental importance to clarify and avoid detrimental impacts of fishing activities on the environment, particularly when these activities overexploit marine resources (Frid *et al.*, 2003; FAO, 2011). Discarding is not always taken into consideration in fish stock assessments, even when it may account for a large proportion of fishing mortality, especially for younger individuals; this can lead to unrealistic and, in some cases, optimistic assessments. When discards form a substantial part of the catch for a given species, it is generally considered that accurate discard data should be included in order to improve fishing mortality and recruitment estimates. If the amount of discards is not considered in the assessment of the status of the stocks and in the implementation of relevant management plans, this can result in unsustainable fishing. In most cases, discards are not included due to a lack of data and systematic sampling, and the associated low precision. Accounting for discard data in stock assessments is therefore important in order to improve the estimates of removals from the population due to fisheries.

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

2. DATA SOURCES

Historically, the collection of discard information from commercial fleets has been carried out in different ways (e.g. logbook, surveys, questionnaires, etc.). Regardless of the selected data source(s), a discard monitoring programme should be designed taking into account the spatial (e.g. GSA) and temporal (e.g. quarter of the year) variabilities in order to identify seasonal and geographical differences in the volume (weight) and demographic structure (length) of both the discarded and landed fractions for different fleet segments.

Where there is little or no prior knowledge on discarding practices, results from short-term exploratory discard sampling (i.e. pilot studies on selected fisheries and/or areas) may be useful in determining which fisheries are most significant in terms of discarding and which ones should be regularly investigated.[2] In most countries, given the size of fishing fleets (mainly composed of small-scale vessels) and the numerous factors that could influence discarding practices, the only realistic way to estimate discards on a yearly basis is through a sampling survey involving observers on board (Section 2.1) and/or the collection of sample data by the fishers (Section 2.2). Additional information could also be collected through interviews/questionnaires carried out at landing sites (Section 2.3).

2.1 OBSERVERS ON BOARD

One of the most accurate methods to estimate discards is to place observers on board a representative selection of fishing vessels so that they can record landing information and collect samples from the discards (Section 3.4 Box 2).

Data collected should include the quantities of each species retained and discarded (from which discard rates could be estimated) and the length of both components of the catch (i.e. landings and discards) (Annex 4 and 7).

Ideally, observers should be equipped with appropriate taxonomic guides: when species cannot be identified, photographs should be taken and, if possible, a sample brought to a laboratory for further research.

The minimum set of data to be collected for each fishing trip and for different fishing for operations is summarized in Box 1.

[2] Based on human and financial resources, the fleet segment(s) that will be investigated by country and GSA will be decided on a yearly basis.

BOX 1
Minimum set of data to be collected

A. Vessel data

- GSA
- Date of fishing trip
- Length of the vessel (length overall [LOA] in metres)
- Power (kW)
- Gross tonnage (GT)
- Port of departure
- Port of arrival
- Gear(s) type and specifications (e.g. length of the net, number of hooks, number of lines)

B. Fishing trip data

- Total number of fishing operations performed during the fishing trip
- Total weight (kg) of all species retained on board (landed fraction)
- Total weight (kg) of all marine living resources discarded (e.g. fish, crustaceans, cephalopods, sharks, skates and other invertebrates)
- Main species in the commercial and discarded fraction

C. Fishing operation data

- Total weight of the discarded fraction (kg) by species
- Total weight of the retained fraction (kg) by species
- Length data of main commercial species landed and discarded
- Sex and maturity data of main commercial species landed and discarded
- Information (e.g. weight and number) on vulnerable species, marine litter, macrobenthos and non-indigenous species

BOX 2
Observers on board

Advantages

Observers may be used for more reasons than merely record and collect discard data; while at sea, they can collect also a wide range of information on fishing operations (e.g. fishing area, duration of the trip, sorting behaviour, number of hauls, type of gear), on commercial species (e.g. length, weight, sex), and on vulnerable species.

Disadvantages

Observer programmes are an excellent way to collect discard data, but the presence of an observer may influence fishers' behaviour (e.g. change in discarding practices, fishing grounds, fishing operations).

Sampling on board poses many difficulties in addition to those associated with working on an unstable platform. When on board commercial vessels, observers have to work with minimum interference with the daily work of the crew and often have very limited time to obtain their samples.

Misidentification can cause many problems, such as inaccurate recording of a species that might be under management and/or recovery plan; it is therefore important that observers are able to identify the species caught.

2.2 SELF-SAMPLING

Self-sampling is a method for fishers to sample their own fishing trips taking a random sample from the total catch and dividing it into retained and discarded fish (Box 3). Incentives for fishers, communication, confidentiality, training and shared motivation are essential for good cooperation (Hoare *et al.*, 2011).

Samples can be collected at sea by fishers and subsequently analysed ashore by scientific staff (Lart, 2002), or fishers can take samples of their own catch and analyse them (i.e. quantifying landings and discards by species). Self-sampling activities require that fishers be well-trained, guidelines be well developed, and collected data be further scrutinized for flaws and controlled for bias.

Ideally, the captain and/or members of the crew should be able to calculate the total catch (landings and discards) for each fishing trip and make an estimation of the weight and/or number of individuals discarded by species.

For each trip and/or fishing operation, the captain and the crew will be asked to collect and store samples (e.g. boxes) of discarded fish, paying particular attention to their representativeness. These samples should be labelled and stored in the fish hold of the vessel. The discarded fish samples should then be packed and returned to the shore (i.e. landing site) where observers can collect information on the composition of the discarded fraction (e.g. volume and length-frequency distributions) and fill in the appropriate template on discard data reporting (Annex 5). The same procedure can be used to report landing data.

It is important that materials for samples be prepared and made available together with reporting forms/sheets. Each vessel should carry two different types of forms to report information on the fishing trips and on catch, including discards. The first form on vessel characteristics should include information on the type of gear, mesh size, fishing area and ports of departure and return (Annex 5.a). The second form should provide information on the fishing operation, including the catch (discards and landings), and on the reasons why particular species of the catch were discarded (Annex 5.b). Moreover, it is necessary to ensure that the captain/crew members understand the objectives of the project and that they are able – and possibly trained – to collect data and samples. For this purpose, it is necessary to establish a participatory framework in order to build mutual trust and collaboration, and set common goals between researchers and the vessel's owner/crew. In addition, training sessions will provide fishers with the necessary information and skills to carry out sampling activities.

BOX 3
Self-sampling

Advantages

At-sea sampling of commercial fisheries catches carried out by observers can be a relatively expensive exercise, both in costs and human resources. As a result of the self-sampling approach, a larger number of trips can be sampled at a lower cost since catch data (landings and discards) can be more representative of the whole fleet segment without involving many observers. Self-sampling activities may complement studies and scientific surveys conducted by observers on board, providing a cost-effective alternative. Furthermore, self-sampling is the only sampling method for certain vessels such as very small or unsafe ones.

Disadvantages

Potential problems with this method are related to the representativeness of the sample. Some scientists and/or managers consider that data provided by fishers may not be rigorously collected and may therefore be biased. To avoid these problems, regular training sessions for fishers should be conducted in order to guarantee the accuracy and reliability of data collection. It is recommended to cross-check data obtained through the self-sampling approach with data collected by observers on board.

2.3 QUESTIONNAIRES

Discard information can also be collected through individual questionnaire-based interviews and following a standardized sampling questionnaire in different ports, landing sites and markets. The questionnaire form (Annex 6) should be designed to collect information on the vessel, fishing gear, fishing practices, location of the main fishing grounds, main target species, estimation of the catches and discards, and the species composition of the discards.

The choice of the sites for interviews in each country should be based on:

- the importance of the local fisheries in terms of national production;
- the historical context (e.g. the relationship between local fishing associations/individual fishers and researchers); and
- the experience of the skippers/crew to be interviewed.

The questionnaire should also contain a specific section dedicated to species of particular interest, such as marine mammals, seabirds, sea turtles and sharks. For this latter group of species, the questionnaire should focus on collecting information on catches, sightings and numbers of individuals.

BOX 4

Questionnaires

Advantages

Fishers are an important source of information to improve discard monitoring programmes so that they better reflect the situation at sea. The face-to-face questionnaire-based interviewing method is more reliable than a mere distribution of questionnaires to be filled in by the fishers. This approach enables to gather views on discards to complement observations on board and to follow an integrated approach to fisheries management.

Disadvantages

Questionnaire contents and wording should be clear to fishers in order to avoid ambiguous information. The surveys should always be administered by interviewers so that interviews are complete and questionnaires more likely to be filled in properly. Interviewers should provide primary quality controls. Although direct interviews are more time-consuming, this approach should be privileged in any survey. Efficiency is also expected to be higher since fishers gain experience in answering questions.

3. SAMPLING STRATEGY

Generally, designing a perfect discard monitoring programme covering all fisheries in all countries is not realistic. Fishing behaviour, catch composition, the nature of the fleet, as well as the availability and capacities of human resources differ from one country to the other. A monitoring programme designed to meet the current needs on a case-by-case basis is therefore required. However, basic information is always necessary before designing any monitoring programme, including:

- total number of fishing vessels operating in the country;
- identified fleet segments operating in the country (based on the Data Collection Reference Framework [DCRF] – Annex 3);
- number of vessels by fleet segment together with:
  fishing techniques (e.g. type of gear);
  fishing effort (e.g. total number of fishing days by fleet segment);
- amount (i.e. weight) of landings per fleet segment;
- main target species per fleet segment;
- spatial and temporal variability of landings; and
- main landing sites.

3.1 SAMPLING VS CENSUS

Discard data require reliable forms of evidence from which robust conclusions can be drawn. The first essential step is to define the best approach to study the population of interest, which can be achieved through a complete inventory (census) or the selection of a sample (sampling).

There are both advantages and disadvantages in using a census or a sample to study a population (Table 1); it is important to note that both methods provide information that can be used to draw conclusions for the whole population.

TABLE 1
Sampling vs census: possible advantages and disadvantages

Study approach	Advantages	Disadvantages
Sampling	• Costs are generally lower than those of a census. • The amount of data to be collected and analysed is smaller than in a census. • Results may be available more rapidly. • If good sampling techniques are used, results can be highly representative of the actual population (i.e. the larger percentage of the catch covered by the sample, the more accurate the data).	• Data may not be representative of the total population, particularly when the size of the sample is small. • Since data are collected from a subset of units and inferences are made on the whole population, they are subject to sampling error. • A smaller number of units reduces the amount of detailed information on the subgroups within a population.
Census	• It provides complete information (i.e. on fishing effort, landings, discards) from all members in a population (e.g. fishing vessels). • Estimates are known with certainty (no sampling error). • Detailed information about small sub-groups within the population is more likely to be available.	• It can be difficult to enumerate all units of the population. • There are higher costs and human resources compared to sampling. • It is generally more time-consuming to collect, process and release data.

The ideal situation would correspond to the full observation of all fishing operations for the whole fleet, but it is generally beyond budget capacities and human resources of many countries. Furthermore, the multi-specificity of the fisheries (e.g. different gear, species and fishing grounds) often requires drawing a sample of information from the whole population that is robust in its design and large enough to be representative.

3.2 SAMPLING PROCEDURES

The two main methods used in monitoring programmes are probability sampling and non-probability sampling. Probability sampling is the best method to create a sample that is truly representative of the population. In non-probability sampling, the selection is not completely random; hence, the resulting sample is not truly representative of the population. Additional characteristics of both methods are listed below.

3.2.1 Probability sampling

The probability sampling method uses some form of random selection. It is based on the fact that every unit of a population has a known and equal chance of being selected. For example, for a population of 100 vessels, each vessel has one chance in a hundred to be chosen. Different probability sampling techniques may be used to improve the efficiency and precision of a sampling design, such as: (i) ***simple random sampling***; and (ii) ***stratified sampling***. If properly implemented, each sampling technique will provide unbiased samples that are representative of the target population.

- ***Simple random sampling*** is the most representative and straightforward probability sampling strategy. This type of sampling involves a selection process in which each member of the population has an equal and independent chance of being selected. It is the most popular method for selecting samples among a population for a wide range of purposes. With simple random sampling, there is effectively no control over the sampling probabilities. Generally, samples are randomly selected from a comprehensive list of members from an identified population, commonly referred to as "sample units".
- ***Stratified sampling*** is a method where not all members of a population have equal chances (greater than zero) of being included in a sample. Compared with random sampling, this strategy is less likely to produce representative samples. In stratified sampling schemes, individuals can be selected on an opportunistic or ad hoc basis. Stratified sampling involves the division of a population into smaller groups, known as "strata", based on shared attributes or characteristics. For each stratum, a random sample is selected with a number of members that is proportional to the size of the stratum when compared to the population. These subsets of strata are then aggregated to form a random sample. This system is commonly applied to fisheries.

3.2.2 Non-probability sampling

Unlike probability sampling, non-probability sampling is not the result of a random selection process. The probabilities for each members in a population are not equal. Members in a non-probability sample are usually selected on the basis of their accessibility or of the researcher's personal judgment. As a consequence, a vessel is more likely to be chosen if it is operating in the researcher's working area or if it is easily accessible.

In non-probability sampling, the relationship between the sample and the target population is unknown. Hence, the sample may or may not accurately represent the entire population and it is not possible to determine whether a sample is unbiased. Therefore, the results of the analysis based on this sampling cannot be used to draw general conclusions about an entire population. This method is used when an exhaustive population list is not available.

3.3 SAMPLING DESIGN

Literature reports a wide variety of sampling designs and estimation formulae that accompany them (Cochran, 1977; Sparre, 2000; Thompson, 2002). Focus is placed here on introducing sampling designs that are likely to be most suitable for fisheries tasks.

3.3.1 Target population

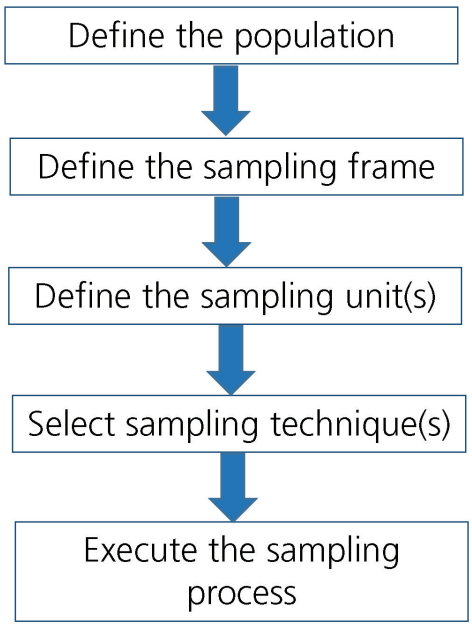
As in any sampling activity, the first essential step is to define the population. For example, taking into account the specificities of each country/GSA, the population of interest may comprise all the vessels in a fleet. Since there is very rarely enough time or money to gather information from every single individual in a population (e.g. fishing vessels), one must find a representative sample of that population. A sample is, by definition, a subset of large population. Therefore, before selecting the sample, it is necessary to have clear idea of the population to be studied.

Hence, in order to obtain a sample from a defined population, it is necessary to be able to describe the population of interest in order to design a method to select a random sample from the population (i.e. the sample frame). The sample frame is the "practical" population: what we actually sample from. Even though it is often difficult to achieve this, it is important to make it match the real population of interest as closely as possible. In large populations, this can be particularly challenging.

Once the sample frame is identified, the second step is to define the sampling unit according to the hierarchical nature of the population. This is the actual unit to be included in the sample (Figure 2).

In this case, the sampling unit could be associated to the fishing trip (Stratoudakis *et al.*, 1999). According to a two-stage stratified random sampling method (Cochran, 1977), the primary sampling unit will be representive of all trips carried out by commercial vessels during a one year period, whereas the secondary unit will include

FIGURE 2
Sampling design process



the different fishing operations (Figure 3). The fleet consists of a number of vessels, each of which carries out a variable number of fishing trips throughout the year, and each trip consists of a variable number of fishing operations (e.g. fishing hauls, pulling traps). These fishing operations are considered the secondary units.

The fishing trip duration is the time elapsed from the moment when the vessel leaves the port until the moment when it returns to the port. In the Mediterranean and the Black Sea, the fishing trip is equivalent in most cases to one fishing day (one fishing trip = one fishing day). The basic assumption is that when a fishing trip includes more than one fishing day, it should be broken down into fishing days (Table 2). This assumption is necessary in order to harmonize data and results between fleet segments, countries and years (GFCM, 2018a).

FIGURE 3
Sampling population, and primary and secondary sampling units

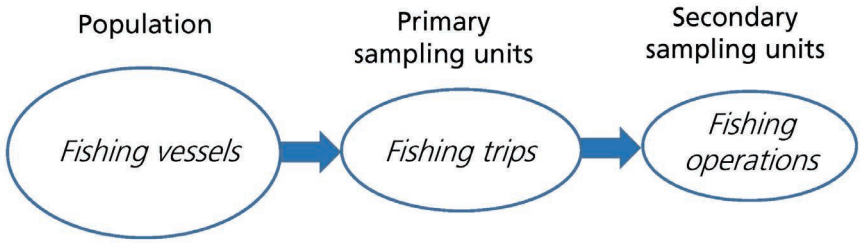


TABLE 2
Conversion of fishing trips into fishing days for a given vessel

	Country 1	Country 2	Country 3
Number of fishing trips per year	60	125	50
Number of fishing days per fishing trip	2	1	3
Total number of fishing days during the year	120	125	150

Note: The last row reports the total number of fishing days.

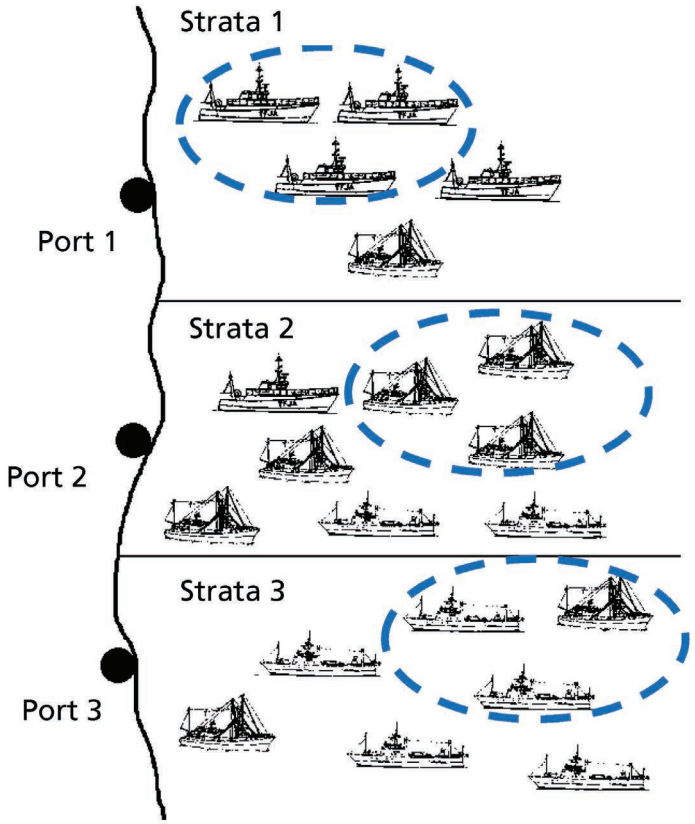
Ideally, the number of fishing trips to be sampled is defined in proportion to the fishing effort (e.g. number of days at sea for each fleet segment) of the previous year(s). The minimum number of fishing days to be sampled should be at least one fishing day per month during the fishing season (Section 3.3.3).

3.3.2 Sampling stratification

From a practical perspective, it is necessary to split the sampling effort (e.g. observers on board), for which stratification is a useful method. From a discard perspective, the identified population (i.e. fishing vessels) should be aggregated into subsets or strata that are similar in terms of fishing activities, length classes and fishing gear. Aggregating fishing vessels with the same operational gear (e.g. trawl, purse seines, trammel net, gillnet) into homogenous and well-defined strata (e.g. fleet segments) can help in reducing the variability between trips and, as a consequence, in the total estimation (Borges *et al.*, 2005).

Statistically, this approach results in highly accurate discard estimates. For instance, if half of the vessels in a particular fishery are composed of purse seiners and the other half, of trawlers, it would seem appropriate to consider these two vessel groups as separate strata. For sampling purposes, it is sometimes necessary to further split the identified strata, on the basis of spatial (port/landing site) and temporal (quarterly) aggregations: a particular GSA may be divided into three strata (e.g. landing sites/port) to be sampled (Figure 4).

FIGURE 4
Concept of strata and stratification



Source: Modified from FAO (2002).

Defining strata typically requires specific knowledge about the fisheries in the area of interest (e.g. target species, main port, and fleet composition). Decisions about stratification will also require taking into consideration the number of available observers. In general, it is better to have relatively few strata so that more than one sample can be obtained from each stratum than to have many strata, many of which are only sampled once or not at all (e.g. fleet segment with few operating vessels).

It is therefore crucial that information on fleet in each country is available and that the fleet is segmented according to the provisions included in the DCRF (Annex 3). This allows reducing sampling costs in order to optimize the allocation of human resources and funds between the strata.

3.3.3 Coverage

From a scientific perspective, it is important to ensure that data collected through each programme provide representative information and sampling for the entire fleet segmentation. Once the strata have been identified, it is necessary to define the number of primary sampling units to be sampled. Ideally, each vessel and/or individual fishing operation should have an equal and independent probability of being observed. For each stratum, the number of sampling units to be included in a sample should be as large as possible in order to be representative (also taking into consideration the available sampling staff and resources). In practice, this may not always be possible to achieve for different reasons, including difficulties in accessing fishing vessels, the lack of space on board, a conflictual relationship with the owner, among others.

Taking these constraints into account, a realistic approach may consider maximizing the coverage on the basis of available funds and observers, and taking into account operational considerations.

Each country, implementing a discards monitoring programme, has the responsibility to assign observers to vessels and cruises on the basis of a carefully studied and appropriately designed sampling scheme that is highly likely to ensure a representative coverage. If possible, one fishing trip at least should be sampled every month during the fishing season, i.e. at least three samples should be collected during each quarter of the year for each fleet segment. All countries are expected to adapt their respective programmes (if any) to meet these minimum standards. Each programme should ensure that, in the main fishing areas and seasons, and to the extent possible, all vessels, areas and periods have the same probability of being sampled.

To this end, based on GFCM requirements, a sampling scheme (Table 3) should be defined by each country at the beginning of the sampling year in order to collect fisheries data on landings and discards.

TABLE 3
Sampling scheme for the collection of fisheries data per fleet segment and GSA

Fleet segments		GSA	Port/landing places	Planned number of fishing trips per month
Trawlers	12–24	X	Y	1
Trawlers	12–24	X	Z	1
Trawlers	6–12	X	H	2
Pelagic trawlers	>24	X	H	1
Seiners	12–24	….	….	….
Purse seiners	> 24	….	….	….
Polyvalent vessels	6–12	….	….	….
Longliners	18–24	….	….	….
….	….	….	….	….

Note: The sample scheme should include the total planned minimum number of fishing observations (e.g. on board fishing trips; questionnaires, etc.) to be carried out per month, by country. The periodicity of the sampling activity should depend on the areas and on the seasonality of the different fishing activities.

3.4 CATCH SAMPLING

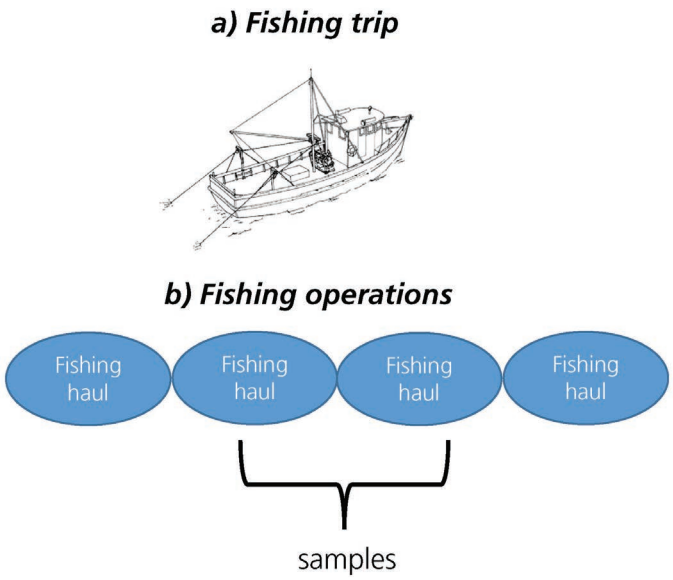
Once on board, observers should record data on discarded and retained fractions by randomly collecting samples (e.g. box, bin) of both components for each fishing operation or for different fishing operations during each fishing trip. In this latter case, the fishing operations should be randomly chosen.

For example, if an observer who is collecting data from a trawler cannot sample the entire fishing trip, samples from fishing hauls should be taken randomly (Figure 5).

Once on board, the observer will chose hauls to sample. According to Cochran's theory, the hauls should be taken randomly. Once again, there is no predefined list of hauls upon which one can base a random sample. General practice is to carry out systematic sampling, spreading the samples equally during a fishing trip (GFCM, 2018a). At times, when a haul is chosen, a subsampling may be performed by dividing the catch into boxes, and when a box is selected, a sample of one species may be drawn for counting, weighing and/or measuring. The on-board observer should pay close attention to taking samples that are as representative as possible of the whole catch.

Depending on the fleet segment investigated, time and space availability, and on the size of the catch, the observer may either sample on board retained and discarded fish separately (Section 3.4.1), or sample the whole catch (Section 3.4.2).

FIGURE 5
Trawler performing several fishing hauls (b) during a single fishing trip (a)

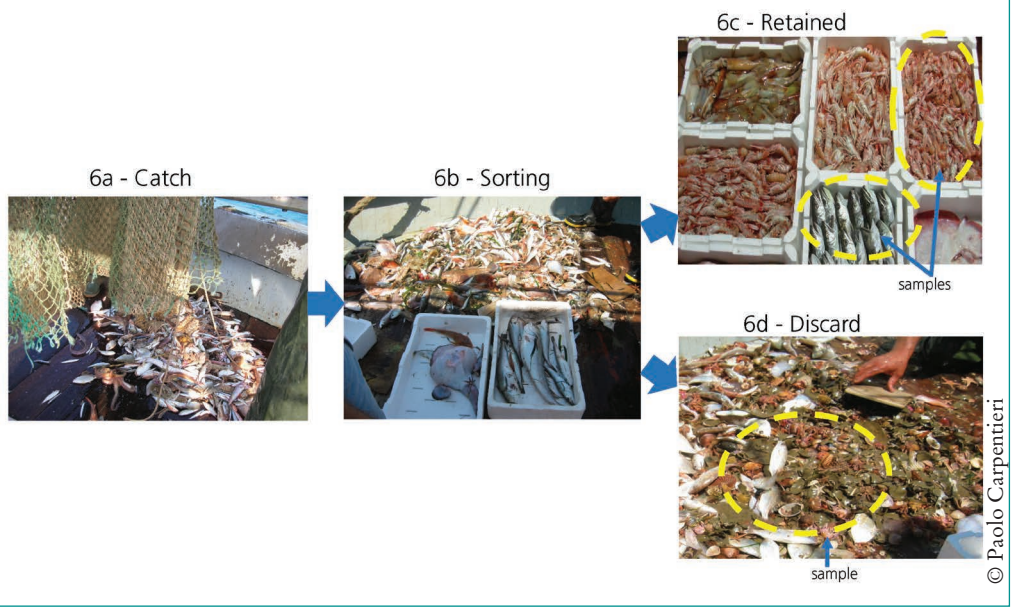


Note: A sample of those hauls (e.g. 2 out of 4) could be representative of the whole fishing day.

3.4.1 Sampling separately retained and discarded fish

This procedure is one of the most common on board commercial vessels. Generally, the catch (Figure 6a) is immediately sorted by the crew (Figure 6b) into retained (Figure 6c) and discarded (Figure 6d) fractions, for a number of reasons (e.g. the crew has to carry out other fishing operations, lack of space on board). The total catch could be determined as the sum of total quantities retained on board and discarded quantities; an evaluation by the captain is often helpful in this process.

FIGURE 6
Different components of the catch before and after sorting



If the abundance of the catch is small, the total numbers and lengths of all species in the discarded and landed fractions can be recorded; otherwise, a sample of both fractions should be taken, ensuring that samples are representative.

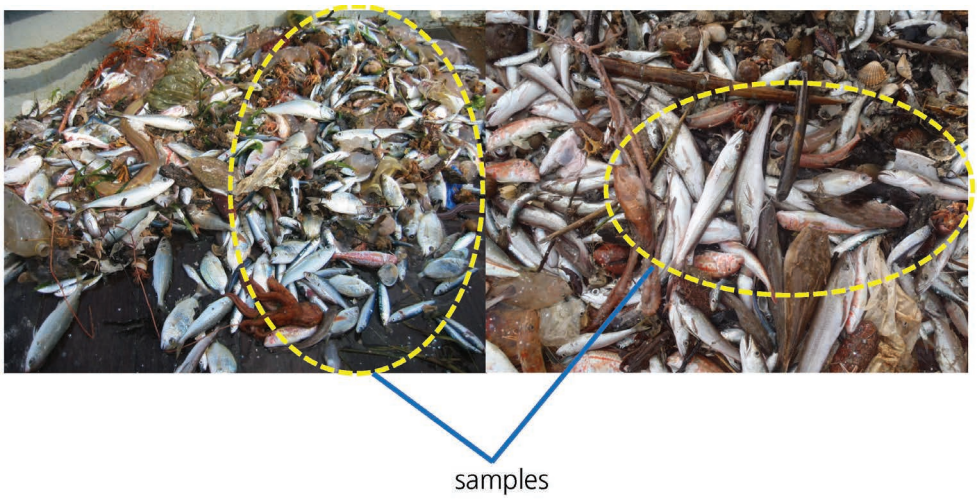
Once a sample from both fractions has been collected, and following the species prioritization (Section 3.5), the observer should: (i) estimate weight and measure the marketable species in the commercial fraction; and (ii) estimate weight and measure the species in the discarded fraction.

3.4.2 Sampling the whole catch before sorting into discarded and retained fractions

This procedure allows to provide a direct estimate of both the quantities discarded and those retained on board. Once the catch is brought on board, and before it is sorted by fishers, observers should take a sample from the whole catch (Figures 7 and 8). The weight of the sample should be estimated and then sorted into marketable fish and discarded material by the crew, and all the specimens in the sample should be processed (i.e. weighted and measured). Then the results should be extrapolated to the whole population from which the sample was taken.

The results obtained with this method depend on who sorts the sample (ICES, 2000). Ideally, the crew sorts it separately from the rest of the catch; however, if the observers sort the catch, the discarding rates may differ from those of the crew.

FIGURE 7
Catch composition on a vessel deck before the sorting procedures



3.4.3 Sampling at landing site

When the vessel is too small to carry an additional person (e.g. small-scale vessels), or if it is impossible to carry out sampling on board for security or safety reasons, or other reasons, sampling activities can also be carried out at landing places (i.e. port, market). This could imply the collection of detailed information for a restricted number of species such as fish species subject to stock assessments. In this case, the captain of a fishing vessel can be asked to bring the part of the catch that is usually discarded at the landing place first and then to the laboratory. If it is not possible to measure a sample of the landed part, the total weight by species should be estimated, and/or if possible, the observers should purchase a box of commercial species for further analysis.

FIGURE 8
Catch composition into baskets before the sorting procedures

3.4.4 Data reporting

All collected data should be reported in ad hoc templates including the characteristics of the vessels (Annex 4.a), the main information for each fishing trip observed (Annex 4.b) and the information for each fishing operation (Annex 4.c). In all templates, catch for both retained and discarded fractions should be reported in kg.

3.5 SPECIES PRIORITIZATION

Data (e.g. length, sex, maturity) can be collected for several species (e.g. main commercial species, species that are locally important, discarded species, non-indigenous species). However, in some cases, due to time constrains, it will be necessary to prioritize the monitoring of catches and biological sampling procedures (e.g. collection of length and weight data) among groups of species (Table 4), focusing first on priority species on the basis of DCRF provisions (GFCM, 2018a). Once data have been collected for priority species, biological data for the other species encountered should also be collected. For all species (both retained and discarded fraction), information on total weight should be always recorded.

TABLE 4
Summary of on-board schemes to be used for the sampling of different species

Groups of species	Priority (1=highest)
Group 1 species (Annex 2.a)	1
Group 2 species (Annex 2.b)	1
Group 3 species (Annex 2.c)	2
Other discarded species	2
Vulnerable species (Annex 10)	2
Non-indigenous species	3
Other commercial species	3
Species of local interest	3
All other species	4

The lists of priority species identified for each group and GFCM subregion are reproduced in Annex 2. Observers are also encouraged to collect samples from other commercial species and any other species that are considered important.

4. MINIMUM REQUIRED DATA

4.1 LENGTH MEASUREMENTS

Based on species prioritization, individual length data should be taken from all individuals in the samples. Length frequency information shows the size structure of a fish population by area and time; this information is the basis for understanding the dynamics of fish populations. In addition, collected data can be used to compare populations (i.e. young specimens or adults) in different places and periods (e.g. seasons, years).

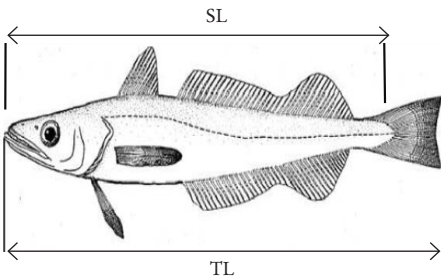
Length measurements, which are easy to carry out, should be well-defined and standardized in order to allow for the comparison of results and to evaluate the monthly length distribution of species, both in the discarded and the landed fractions.

The length measurements to be taken depend on the group of species under study. The length of fish and cephalopods is generally measured with graduated fish measuring instruments (i.e. ichthyometers), while crustaceans are measured with calipers. The methodology to be used to collect length data should be aligned with the DCRF manual (GFCM, 2018a), as reported below.

Bony fish and elasmobranchs – For bony fish, sharks, skates and rays, the length to be considered is the total length (TL). The fish is measured to the lower half centimeter (cm), from the tip of the snout to the end of the caudal fin (Figure 9a and 9b). For elasmobranchs, fork length (FL) can be recorded when the caudal fin is damaged and the TL cannot be measured. For the same reasons, standard length (SL), which is defined as the measurement taken from the tip of the lower jaw to the posterior end of the hypural bone, can be used for bony fish.

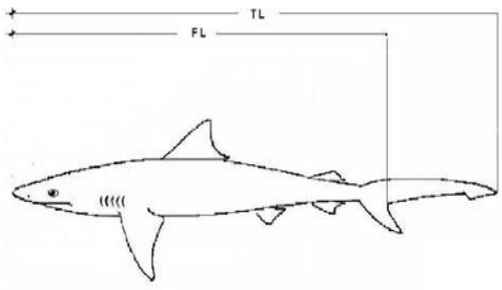
The length classes should be reported in centimeters (cm) as a whole or half number (e.g. 0.5, 1.0, 1.5). A length data entry sheet for fish and elasmobranchs is reproduced in Annex 7.a.

FIGURE 9A
Measurement of total length (TL) and standard length (SL) in bony fish



Source: GFCM, 2018a.

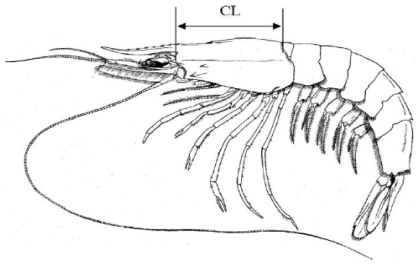
FIGURE 9B
Measurement of total length (TL) and fork length (FL) in elasmobranchs



Source: GFCM, 2018a.

Crustaceans – For crustaceans (lobsters, crawfish, shrimps, prawns, stomatopods), the standard measurement is the length of the carapace (CL). The length classes should be reported in millimetres (mm) as a whole number (e.g. 1, 2, 3, 4). The crustacean is measured to the lower mm from the back border of the eye orbit (inside of the eye socket) to the posterior margin of the carapace (Figure 10). All measurements are made with calipers. The length data entry sheet for crustaceans is reproduced in Annex 7.b.

FIGURE 10
Measurement of carapace length (CL) for crustacean Decapoda



Source: GFCM, 2018a.

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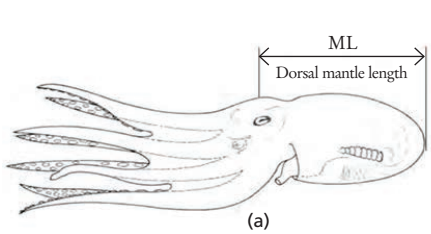
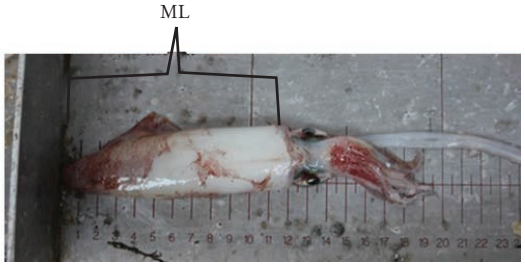
Cephalopods – For cephalopods, the length to be considered is the dorsal mantle length (ML). The cephalopod is measured to the nearest lower half cm. The size should be reported in centimeters (cm) as a whole or half number (e.g. 0.5, 1.0, 1.5). For Octopoda, measurement is taken along the median line, passing through the eyes to the apex of the mantle (Figure 11). For Decapoda, measurement is made along the dorsal midline from the mantle margin to the posterior tip of the body, excluding long tails. Length data entry sheet for cephalopods is reproduced in Annex 7.a.

FIGURE 11
Measurement of dorsal mantle length (ML) of cephalopods
a) Octopoda and b) Decapoda



(a)



(b)

Source: Dimech *et al.* (2012); MEDITS Handbook (2016).

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4.2 OTHER BIOLOGICAL DATA

Whenever possible, other biological data (e.g. sex, maturity) on commercial catch should be collected in each sample. A large number of macroscopic maturation scales is available in the literature, varying from over-simplified scales comprising three to four stages, to highly specific and relatively complicated scales comprising up to nine stages. The need to adopt a common, acceptable maturity scale and to establish objective criteria for the definition of each maturity stage is considered crucial in order to have a common tool for the exchange of data and scientific information (Follesa and Carbonara, 2019). In this respect, it is important that, irrespective of the maturity scales used by each country in the sampling process, the information gathered should be reported based on the DCRF provisions (Annex G of the DCRF manual – GFCM, 2018a). Macroscopic observation can distinguish sex categories: male (M), female (F), undetermined (U) (when the sex of the species is not visible to the naked eye after dissection) and not determined (ND) (when individuals have not been examined). Maturity data entry sheets for the different groups of species (i.e. fish, crustaceans, elasmobranchs and cephalopods) are reproduced in Annexes 8. Maturity and length data collected during a discard monitoring programme can be used both to define the length frequency distribution of discarded and landed fractions, and to estimate the length at first maturity (L_{50}): the size at which 50 percent of the populations attains an advanced stage of gonad development.

5. ESTIMATING DISCARDS

Discard rate is commonly considered the proportion of the total catch that is discarded at sea (Kelleher, 2005). The importance of estimating the rates of the discarded quantities for commercial fish stocks has long been stressed by fisheries scientists, since discards can be an important component of the total catch of several fisheries. However, since now, relatively few assessments have taken discards into consideration (Section 1.3). This happens mostly due to the long time series needed and to the large amount of research effort needed to obtain this kind of information (Alverson *et al.*, 1994; Kelleher, 2005). The few available estimates are usually based on discard data collected by scientific observers on board commercial fishing vessels or from other source of information as part of national sampling programmes (EU, 2011).

There is extensive literature dedicated to assessing total discards to specific fleets and species, and there are many different options available for raising samples to the whole population (ICES, 2000; Sparre, 2000; Stratoudakis *et al.*, 2001; Cotter *et al.*, 2002). Each method has its advantages and disadvantages, but no method can be considered the best fit for all fisheries (Vigneau, 2006). For example, when raising discard samples to stock level, there are numerous auxiliary variables (e.g. total landings in weight, effort in fishing hours or in numbers of fishing trips, etc.), which, if considered, often give significantly different results (Stratoudakis *et al.*, 2001; Trenkel and Rochet, 2001). Any raising procedure requires, as a minimum, knowledge of its related quantity (landings or effort) at the population level. This quantity usually originates from logbooks, ad-hoc surveys and/or other official fisheries statistics. There could be also some general issues associated to the raising of discard data (e.g. raising variable, equal strata between sampling and population, low sampling level, etc.), which might cause unrepresentativeness of sampling and underestimates the heterogeneity of the population (ICES, 2004, 2007). Furthermore, sampling of discards, and as a consequence the raising of discard data, is done at multiple stages and all stages includes also variance which should then be raised to population level (Allen *et al.*, 2002; Vigneau *et al.*, 2007). In order to get sound estimates of discards it is important that the variable used is as reliable as possible (ICES, 2007). It is also a prerequisite for raising discards that the same strata can be defined in samples and at the population level.

Generally, the collection of samples based on data stratification hierarchy (i.e. fishing haul, fishing trip, fishing vessel – Figure 3) requires converting the results obtained from individual discard samples to an estimate of the discards of the entire population (e.g. fleet segment) over a given sampling period (e.g. a year and/or a quarter).

The discard rate, for the total catch of an observed fishing trip, can be determined by the sum of the total quantity (in kg or number) of the discarded fraction divided by the total quantity caught (i.e. landed/retained + discarded):

$$\textit{Discard rate (\%)} = \frac{\text{(SUMMED DISCARDS)}}{\text{(SUMMED DISCARDS+SUMMED LANDING)}} \times 100$$

For the unobserved fishing trips, simple estimates can be then applied to the total landings of a fishery to raise or extrapolate the tonnage of discards to the level of the whole fishery. It is important that these estimates should be performed at the stratum level (e.g. fleet segment level: vessels with the same gear type/mesh size and operating in the same area with similar catch composition). This means that the discard rates of a sample (e.g. of a vessel; of a fishing trip), can be applied to the total landings to derive

the total quantity of discards (e.g. at fishing trip level; at fleet segment level; etc.). These estimates, in terms of numbers of fish or their weight, are based on the assumption that the catches sampled, and the discards from them, are representative of all the catches made during a fishing trip. Sometimes, this relationship does not necessarily hold true at the level of individual vessel trips or fishing operations, or in relation to the landings of target species, and the linear nature of the relationship is open to question (Trenkel and Rochet, 2001; Borges *et al*., 2005; Rochet and Trenkel, 2005).

5.1 DISCARD RATIO ESTIMATOR FOR MAIN COMMERCIAL SPECIES

Regarding the amount of discards, on the volume of landings, a simply discard ratio estimator (R) for the main exploited commercial species is also proposed (Cochran, 1977; Thompson, 1992; Vigneau, 2006). Clearly for species that are completely discarded, with zero volume of landing, the discard ratio estimator should correspond to 1.

The ratio estimator of discards (R) for a given species in a given stratum is estimated on the sampling data and can be estimated by dividing the discarded amount (D) of the species in the stratum (e.g. fleet segment, fleet segment-quarter) by the amount of all retained commercial species (landed fraction, L) in the stratum S:
where:

$$\hat{R}_{j,S} = \frac{D_{j,S}}{L_S}$$

$\hat{R}_{j,S}$ estimated discard ratio of species *j* in a given stratum *S*,

$D_{j,S}$ observed or estimated discarded weight of species *j* in stratum *S*,

L_S observed total weight of the landed (retained) fraction *L* in stratum *S*.

$D_{j,S}$ and L_S are calculated as follows:

$$D_{j,S} = \sum_{h=1}^{n} D_{j,h} \quad \text{and} \quad L_S = \sum_{h=1}^{n} L_h$$

where *h* is the fishing operation identifier within stratum *S*, and *n* is the total number of fishing operations sampled within stratum *S*.

The variance of total discards (VarD) per species and stratum can be calculated starting from the estimated variance of the discard ratio (VarR) per species and stratum from the sampled data as follows:

$$Var\left[\hat{R}_{j,S}\right] = \frac{(1-f_S)}{n\overline{L_S}^2}\left(s_{D_{j,S}}{}^2 + \hat{R}_{j,S}{}^2 s_{L_S}{}^2 - 2\hat{R}_{j,S} s_{DL_{j,S}}\right)$$

where:

f =n/N (n stands for the number of fishing operations sampled in a stratum and N for the total number of fishing operations in that stratum), $\hat{R}_{j,S}$ estimated discard ratio for species *j* and stratum *S*,

$S_{D_{j,S}}{}^2$ sampling variance of discards,

$S_{L_S}{}^2$ sampling variance of retained species (landings),

$S_{DL_{j,s}}$ sampling covariance discard-landing for species *j* and stratum *S*.

If the total landings per stratum L_{T_S} are known, the estimated discard ratio for each species in each stratum can be used to calculate the total discards per species and stratum as follows:

$$\hat{D}_{T_{j,S}} = \hat{R}_{j,S} L_{T_S}$$

Once the variance of discard ratio $Var\left[\hat{R}_{j,S}\right]$ is estimated, then the variance of the total discards of the fleet (D) per species per stratum, $Var\left[\hat{D}_{T_{j,S}}\right]$, can be estimated as:

$$Var\left[\hat{D}_{T_{j,S}}\right] = (1-f)\left(\frac{L_{T_S}{}^2}{L_S} Var\left[\hat{R}_{j,S}\right]\right)$$

The total discards per $\hat{D}_{T_j}$ species can then be calculated by summing strata S:

$$\hat{D}_{T_j} = \sum_{S=1}^{nS} \hat{D}_{T_{j,S}}$$

where nS is the number of strata sampled.

These estimates should be calculated on a yearly basis. The same procedures should be applied for quarterly estimations.

5.1.1 Coefficient of variation for discard ratios

The coefficient of variation (CV) is a standardized measure of dispersion defined as the ratio of standard deviation (σ) and mean (μ) population. The CV is estimated with the sample standard deviation (as an estimate of σ) and the sample average (as an estimate of μ). Therefore, the CV of the discard ratio for a given stratum can be estimated based on the estimated variance of $\hat{R}_{j,S}$ as follows:

$$CV(\hat{R}_{j,S}) = \frac{\sqrt{Var\left[\hat{R}_{j,S}\right]}}{\hat{R}_{j,S}} = \frac{SD\left[\hat{R}_{j,S}\right]}{\hat{R}_{j,S}}$$

The CV of the total discards of the fleet per stratum can be easily estimated, based on the estimated variance of D, as described in the previous section:

$$CV(\hat{D}_{T_{j,S}}) = \frac{\sqrt{Var\left[\hat{D}_{T_{j,S}}\right]}}{\hat{D}_{T_{j,S}}} = \frac{\sqrt{Var\left[\hat{R}_{j,S}\cdot L_{T_S}\right]}}{\hat{R}_{j,S}\cdot L_{T_S}} = \frac{\sqrt{L_{T_S}^2\cdot Var\left[\hat{R}_{j,S}\right]}}{\hat{R}_{j,S}\cdot L_{T_S}} = \frac{L_{T_S}\sqrt{Var\left[\hat{R}_{j,S}\right]}}{\hat{R}_{j,S}\cdot L_{T_S}} = \frac{\sqrt{Var\left[\hat{R}_{j,S}\right]}}{\hat{R}_{j,S}} = \frac{SD\left[\hat{R}_{j,S}\right]}{\hat{R}_{j,S}}$$

The estimated CV of the discard ratio and the estimated CV of the total discards of the fleet for a given species are identical at the individual stratum level.

5.2 DISCARD SIZE AT 50 PERCENT

Size composition of discards is important information for investigating differences in discarding between fleet segments and areas.

For the most important species, whenever possible, a 50 percent probability discard length (DL_{50}) can be calculated using data collected on the size structure of discarded and retained individuals to fit a selection ogive curve. The relationship between percentages P_d of discarded fish at length class L is widely used for fishing gear selectivity studies (Stergiou, Petrakis and Politou, 1996) and can be described by the following logistic function:

$$P_d = 1/(1+\exp(s_1 - s_2 * L_{sc})$$

where P_d represents the proportion of individuals discarded for size class; (proportion by length class = discarded fraction/total [i.e. retained+discarded]).
L_{sc} represents the length size class, s_1 represents the intercept, and s_2 the slope of the curve after applying a logit transformation, which can be calculated using the method described by Petrakis and Stergiou (1997).

The s_1/s_2 ratio provides the length (DL_{50}) at which the probability of being discarded is equal to 0.5 (Stratoudakis, Fryer and Cook, 1998):

$$DL_{50} = - s_1/s_2$$

6. ECOSYSTEM DATA

6.1 VULNERABLE SPECIES

Concern over the incidental catch of vulnerable species (i.e. marine mammals, seabirds, sea turtles and sharks – see Annex 10) in commercial fishing operations has grown considerably over the past few decades. However, the information is still limited for identifying fisheries with incidental catches of vulnerable species. Limited or non-existent information from Mediterranean and Black Sea countries regarding the bycatch rates of vulnerable species makes it impossible to assess the likely conservation threats posed by total bycatch levels (FAO, 2016, 2018). Furthermore, the few available data do not necessarily allow for an accurate and realistic assessment of vulnerable species and of the impact of incidental catch on these populations.

Although the requirements for estimating bycatch of vulnerable species are different from those for estimating discards (in particular, further data analysis and data collection are necessary to produce robust total catch estimates for vulnerable species), the methodological approach is similar: on-board observer programmes are widely recognized as the best way to obtain reliable information on the bycatch of vulnerable species. Therefore, when monitoring discard activities, it is also important to collect a minimum set of data on vulnerable species (i.e. number of individuals taken as well as fleet segments and areas). Primary collected data should be reported in an aggregated form by area (GSA) and by species group and/or family, if detailed information by species is not available (e.g. when individual could not be identified at the species or genus level, such as for seabirds, due to the large number of possible species). It is also important to report, together with the total number of individuals caught, whether they have been released alive, dead or in an unknown status (Box 5). If no observation has been made, this should also be indicated in the dedicated template (Annex 9) in order to make it possible to distinguish between hauls without bycatch of vulnerable species, and hauls for which no observations were made. Such on-board observations could represent additional/alternative sources of information to provide guidance for any possible revision of incidental catches monitoring programmes.

BOX 5

Minimum set of data to be collected in case of incidental catch of vulnerable species

For each trip, observer should also estimates and report (if any) data on:

- Fleet segment
- Fishing gear
- Group of vulnerable species
- Family
- Species (identified as far as possible, or accompanied by photographs if identification is difficult)
- Total number of individuals caught
- Total weight of individuals caught
- Condition at capture and condition at release:
  - Number of individuals captured/released alive
  - Number of captured/released dead individuals
  - Number of captured/released individuals in unknown status

6.2 NON-INDIGENOUS SPECIES

In recent decades, non-indigenous species (i.e. any species introduced – either intentionally or unintentionally, outside its natural past or present distribution, also known as "exotic" or "alien" species), have been frequently caught by commercial fishing gears in different areas, accounting for a large share of the catch in some cases. In light of this rapid increase, there is a need to collect information in order to measure their impacts on fisheries and ecosystems as well as their socio-economic impacts. On-board discards programmes could therefore offer an opportunity to collect important data regarding the distribution of non-indigenous species as well as their quantitative and qualitative impacts in order to contribute to an effective management strategy.

Information should be collected and reported using a dedicated template (Annex 11) including a minimum set of parameters, such as the number of individuals caught per fleet segment and/or per fishing gear by area.

6.3 MARINE LITTER

Litter in the marine environment not only has negative environmental impacts, but can also have negative economic and social impacts on fisheries (UNEP-MAP, 2015). To date, data on marine litter have been inconsistent and geographically restricted to some areas in the Mediterranean and the Black Sea, which explains why the understanding of these impacts is still limited. Harmonized research data for statistical purposes regarding the issue of marine litter in the whole region are still necessary; in this case as well, observer programmes can be a valuable source of information. Although the assessment of marine litter is beyond the scope of these guidelines, it is important to provide, for each fishing trip and by fishing operation, a rough estimate of the quantity (weight) and the quality (type) of any human material (i.e. macro-litter) that may be brought up onto the boat during fishing operations (e.g. plastics, wood, metals, glass, rubber, clothing, ghost nets). An indicative list of relevant data that should be provided is reported in Annex 12.

6.4 MACROBENTHOS

Fishing is the most widespread human activity exploiting the marine environment and has a direct impact not only on target species, but also on the entire marine community, including the benthic organisms (Figure 12). The importance of benthic habitats to ecological processes and as providers of key ecosystems services is unquestionable. In particular, macrobenthos, generally defined as a group of marine invertebrate organisms that live in (infauna) or on (epifauna) the sediment, due to their direct dependency on the sediment, became a valuable fraction of the ecosystems and are frequently used as bio-indicators in ecological assessment (Pinto *et al.*, 2009).

Species distribution, abundance and diversity of benthic macroinvertebrate fauna, and the relationships to environmental conditions are important in the understanding of the structure and functions of different ecosystems.

Macrobenthos form the key element of the food web and serve as the primary food source for fish and other higher organisms, playing a major role in the maintenance, well-being and dynamics of the ecosystem. The collection of such data (e.g. presence and abundance of different microbenthic species) through on-board observations would provide a unique opportunity to increase knowledge of benthic assemblages and to produce basic information on their distribution within the region.

For the purpose of these guidelines, macrobenthos are considered all the organisms that are visible to the eye without the aid of a microscope and pertaining to major taxonomic phylum, for example Porifera (e.g. sponges), Cnidaria (e.g. corals), Briozoa, Echinodermata (e.g. sea stars, sea urchins, sea cucumbers), Crustacea, Mollusca (e.g. bivalves and gastropods) Annelida (e.g. polychaetes) and Tunicata (e.g. ascidians) (Figure 13).

FIGURE 12
Benthic macroinvertebrates in the catch composition

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FIGURE 13
Example of different species of macroinvertebrates present in a catch

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On board, observers can routinely identify and report data on a large diversity of benthic macroinvertebrates and provide useful information on the abundance and distribution of these species in the ecosystem. Owing to the difficulty of collecting information on all benthic species present in a catch composition, attention should focus mainly on vulnerable benthic species that may form vulnerable marine ecosystems (VME) as defined by FAO (FAO, 2009; GFCM, 2018b). VMEs are characterized by slow resistance and resilience from environmental short-term or chronic disturbance. They are easily disturbed and very slow to recover, or may never recover from such disturbance. VMEs are therefore highly susceptible to the impact of bottom fishing gear (i.e. significant adverse impact of fisheries) (FAO, 2009). It is important to underline that the presence of individuals of vulnerable benthic species does not necessarily imply the occurrence of a VME but specific communities, habitats and sea-bottom features may display characteristics consistent with the possible occurrence of VMEs.

Among VME indicator taxa, corals (phylum Cnidaria) and sponges (phylum Porifera) are known to be the main habitat-forming structures, often with numerous species living within or around their body structures. The GFCM defined a series of VME indicators such as features, habitats and taxa for the Mediterranean Sea (Box 6) which, whenever possible should be recorded and reported in Annex 13.

Ideally, once the catch has been sorted, macrobenthic individuals should be identified to the minimum taxonomic level, and species is obviously the basic taxonomic level to which to refer (for a correct identification by fishers and fishery observers see also the figures in: Deep-sea sponges and corals; FAO, 2017a, b). However, many species pertaining to the macrobenthos groups are difficult to identify due to the scarcity of taxonomic expertise (e.g. variable levels of taxonomic expertise on board vessels) and consequently there is a high risk of misclassification, or due to the fact that there are species still awaiting formal scientific description. Therefore, the aggregation of species to higher taxonomic levels (e.g. family or species group) may at times be unavoidable. A minimum set of parameters should be then reported, such as the total number of individuals caught per fishing operation and weight (Annex 13). In some cases, biological samples should be collected and brought to the laboratory, and/or a photograph should be taken to avoid misclassification. Some national laboratories already record this benthic component, although no agreed protocols for the collection and submission of data exist.

Once collected, data could serve to produce basic information for different ecosystem in term of species richness (i.e. number of species), abundance (the counts of individuals for every species) and biomass (i.e. weight).

BOX 6

Mediterranean VME indicator: features (a), habitats (b) and taxa (c)

(a) Mediterranean VME indicator features

The following features potentially support VMEs:

- Seamounts and volcanic ridges
- Canyons and trenches
- Steep slopes
- Submarine reliefs (slumped blocks, ridges, cobble fields, etc.)
- Cold seeps (pockmarks, mud volcanoes, reducing sediment, anoxic pools, methanogenetic hard bottoms)
- Hydrothermal vents

(b) Mediterranean VME indicator habitats

The following habitats potentially support VMEs:

- Cold-water coral reefs
- Coral gardens
  - Hard-bottom coral garden
  - Soft-bottom coral gardens
- Sea pen fields
- Deep-sea sponge aggregations
  - "Ostur" sponge aggregations
  - Hard-bottom sponge gardens
  - Glass sponge communities
  - Soft-bottom sponge gardens
- Tube-dwelling anemone patches
- Crinoid fields
- Oyster reefs and other giant bivalves
- Seep and vent communities
- Other dense emergent fauna

(c) Mediterranean VME indicator taxa

Phylum	Class	Subclass (Order)
Cnidaria	Anthozoa	Hexacorallia (Antipatharia, Scleractinia)
		Octocorallia (Alcyonacea, Pennatulacea)
		Ceriantharia
	Hydrozoa	Hydroidolina
Porifera (sponges)	Demospongiae	
	Hexactinellida	Amphidiscophora
		Hexasterophora
Bryozoa	Gymnolaemata	
	Stenolaemata	
Echinodermata	Crinoidea	Articulata
Mollusca	Bivalvia	Gryphaeidae (*Neopycnodonte cochlear, N. zibrowii*)
		Heterodonta* (Lucinoida) (e.g. *Lucinoma kazani*)
		Pteriomorphia* (Mytiloida) (e.g. *Idas modiolaeformis*)
Annelida*	Polychaeta	Sedentaria (Canalipalpata) (e.g. *Lamellibrachia anaximandri, Siboglinum* spp.)
Arthropoda*	Malacostraca	Eumalacostraca (Amphipoda) (e.g. *Haploops* spp.)

* only chemosynthetic species that indicate the presence of a cold seep or hydrothermal vent are considered.

7. CONFIDENTIALITY OF DATA AND INFORMATION

All data and information obtained within the framework of a discard monitoring programme are property of the countries. Observers should not disclose any information without the permission of the flag country. Each country is responsible for the quality and completeness of collected data (GFCM, 2018a). Collected data should be submitted by countries every year following the DCRF provisions (GFCM, 2018a).

Data and information transmitted by countries should be treated by the GFCM secretariat in accordance with all necessary measures to comply with GFCM security and confidentiality provisions. Through its Secretariat, GFCM will define and maintain high levels of protection for the data transmitted by countries complying with GFCM data submission requirements, as endorsed by the Commission. Data put at the disposal of dedicated expert groups will be treated in the same manner as data used by the GFCM Working Groups on Stock Assessment: all participants should have access to the data needed to address the objectives of the meeting. The use of shared data outside the framework of GFCM or for purposes other than the agreed objectives should follow the existing GFCM data confidentiality rules.

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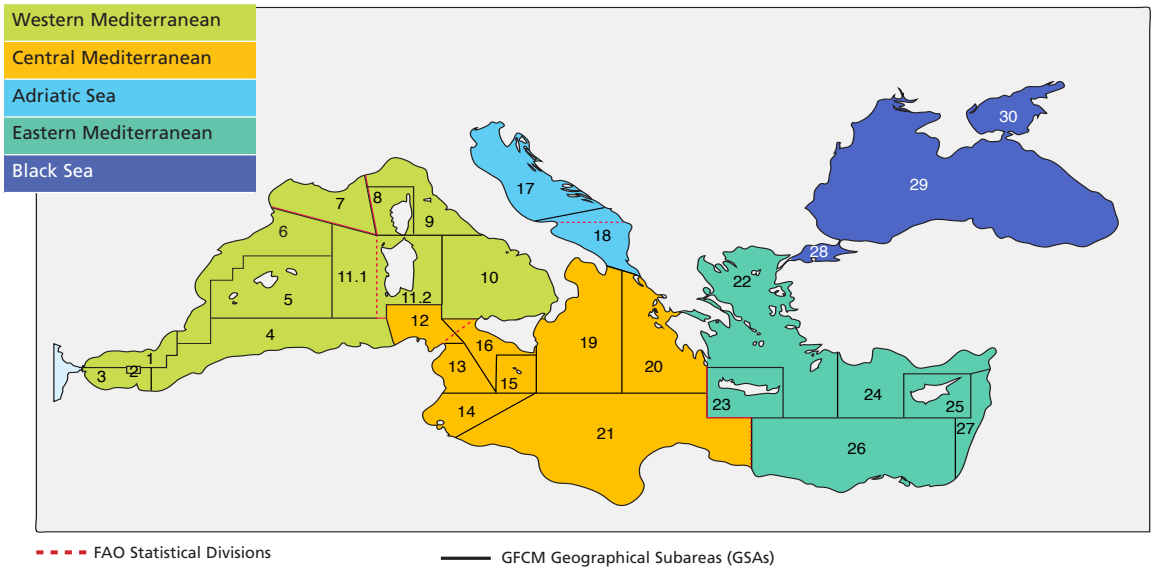
Annex 1. GFCM subregions and geographical subareas (GSAs)

GFCM subregions



GFCM GSAs

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

Source: (GFCM, 2018a).

Annex 2. List of priority species by subregion

ANNEX 2.a. GROUP 1: SPECIES WHICH DRIVE THE FISHERY AND FOR WHICH ASSESSMENT IS REGULARLY CARRIED OUT

			Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
		GFCM subregions ►					
		GSAs ►	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	12, 13, 14, 15, 16, 19, 20, 21	17, 18	22, 23, 24, 25, 26, 27	28, 29, 30
		Countries ►	Algeria, France, Italy, Monaco, Morocco, Spain	Italy, Greece, Libya, Malta, Tunisia	Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, Slovenia	Cyprus, Egypt, Greece, Israel, Lebanon, Syrian Arab Republic, Turkey	Bulgaria, Georgia, Romania, Turkey, Ukraine[a]
Species	**Scientific name**	**FAO 3-letter code**					
Pelagics	*Engraulis encrasicolus*	ANE	X	X	X	X	X
	Sardina pilchardus	PIL	X	X	X	X	
	Sardinella aurita	SAA	X	X		X	
	Sprattus sprattus	SPR					X
	Trachurus mediterraneus	HMM					X
Demersal	*Aristaeomorpha foliacea*	ARS		X		X	
	Aristeus antennatus	ARA		X		X	
	Lagocephalus sceleratus	LFZ	X	X	X	X	
	Merlangius merlangius	WHG					X
	Merluccius merluccius	HKE	X	X	X	X	
	Mullus barbatus	MUT	X	X	X	X	
	Mullus surmuletus	MUR	X	X		X	
	Nephrops norvegicus	NEP	X	X	X		
	Pagellus bogaraveo	SBR	X				
	Parapenaeus longirostris	DPS	X	X	X	X	
	Pterois miles	UHQ	X	X	X	X	
	Rapana venosa	RPW					X
	Scophthalmus maximus	TUR					X
	Sepia officinalis	CTC			X		
	Solea solea	SOL			X		
	Squalus acanthias[b]	DGS					X
	Squilla mantis	MTS			X		
Additional species[c]	*Anguilla anguilla*	ELE	X	X	X	X	
	Corallium rubrum	COL	X	X	X	X	
	Coryphaena hippurus	DOL		X	X	X	
	Sarda sarda	BON					X
	Saurida lessepsianus[d]	SZX				X	

[a] All states, including GFCM non-contracting parties that are known to fish in the GFCM area of application, are encouraged to cooperate in joint actions undertaken in accordance with applicable international obligations (i.e. Article 63 of the United Nations Convention on the Law of the Sea [UNCLOS]).

[b] Species included in Annex III (species whose exploitation is regulated) of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) – Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean.

[c] As identified by the mid-term strategy (2017–2020) towards the sustainability of Mediterranean and Black Sea fisheries (GFCM, 2016).

[d] The species is not currently present in the Aquatic Sciences and Fisheries Information System (ASFIS) list, and thus the 3-letter code of its genus (*Saurida* spp.) has been used.

ANNEX 2.b. GROUP 2: SPECIES WHICH ARE IMPORTANT IN TERMS OF LANDING AND/OR ECONOMIC VALUES AT REGIONAL AND SUBREGIONAL LEVELS, AND FOR WHICH ASSESSMENT IS NOT REGULARLY CARRIED OUT

GFCM subregions ►		Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
GSAs ►		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	12, 13, 14, 15, 16, 19, 20, 21	17, 18	22, 23, 24, 25, 26, 27	28, 29, 30
Countries ►		Algeria, France, Italy, Monaco, Morocco, Spain	Italy, Greece, Libya, Malta, Tunisia	Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, Slovenia	Cyprus, Egypt, Greece, Israel, Lebanon, Syrian Arab Republic, Turkey	Bulgaria, Georgia, Romania, Turkey, Ukraine[a]
Scientific name	**FAO 3-letter code**					
Alosa immaculata	SHC					X
Aristeus antennatus	ARA	X				
Boops boops	BOG	X	X	X	X	
Chamelea gallina	SVE			X		
Diplodus annularis	ANN		X			
Eledone cirrhosa	EOI	X		X		
Eledone moschata	EDT			X		
Galeus melastomus	SHO	X				
Lophius budegassa	ANK	X	X			
Micromesistius poutassou	WHB	X				
Octopus vulgaris	OCC	X	X	X	X	
Pagellus erythrinus	PAC	X	X	X	X	
Raja asterias	JRS	X				
Raja clavata	RJC	X	X			
Saurida undosquamis	LIB				X	
Scomber japonicus	MAS	X			X	
Scomber scombrus	MAC	X	X			
Sepia officinalis	CTC	X	X			
Siganus luridus	IGU				X	
Siganus rivulatus	SRI				X	
Solea solea	SOL				X	
Sphyraena sphyraena	YRS		X			
Spicara smaris	SPC			X	X	
Trachurus mediterraneus	HMM	X				
Trachurus picturatus	JAA	X				
Trachurus trachurus	HOM	X	X		X	

[a] All states, including GFCM non-contracting parties that are known to fish in the GFCM area of application, are encouraged to cooperate in joint actions undertaken in accordance with applicable international obligations (i.e. Article 63 of UNCLOS).

ANNEX 2.c. GROUP 3: SPECIES WITHIN INTERNATIONAL/NATIONAL MANAGEMENT PLANS AND RECOVERY AND/OR CONSERVATION ACTION PLANS; NON-INDIGENOUS SPECIES WITH GREATEST POTENTIAL IMPACT

GFCM subregions ►		Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
GSAs ►		1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	12, 13, 14, 15, 16, 19, 20, 21	17, 18	22, 23, 24, 25, 26, 27	28, 29, 30
Countries ►		Algeria, France, Italy, Monaco, Morocco, Spain	Italy, Greece, Libya, Malta, Tunisia	Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, Slovenia	Cyprus, Egypt, Greece, Israel, Lebanon, Syrian Arab Republic, Turkey	Bulgaria, Georgia, Romania, Turkey, Ukraine[a]
Scientific name	FAO 3-letter code					
Dalatias licha	SCK	X	X	X	X	
Dipturus oxyrinchus	RJO	X	X	X	X	
Etmopterus spinax	ETX	X	X	X	X	
Galeus melastomus	SHO		X	X	X	
Hexanchus griseus	SBL	X	X	X	X	
Mustelus asterias[b]	SDS	X	X	X	X	
Mustelus mustelus[b]	SMD	X	X	X	X	
Mustelus punctulatus[b]	MPT	X	X	X	X	
Myliobatis aquila	MYL	X	X	X	X	
Prionace glauca[b]	BSH	X	X	X	X	
Pteroplatytrygon violacea	PLS	X	X	X	X	
Raja asterias	JRS		X	X	X	
Raja clavata	RJC			X	X	X
Raja miraletus	JAI	X	X	X	X	
Scyliorhinus canicula	SYC	X	X	X	X	X
Scyliorhinus stellaris	SYT	X	X	X	X	
Squalus acanthias[b]	DGS	X	X	X	X	
Squalus blainville	QUB	X	X	X	X	
Torpedo marmorata	TTR	X	X	X	X	
Torpedo torpedo	TTV	X	X	X	X	
Fistularia commersonii	FIO				X	
Marsupenaeus japonicus	KUP				X	
Metapenaeus stebbingi	MNG				X	
Scomberomorus commerson	COM				X	

[a] All states, including GFCM non-contracting parties that are known to fish in the GFCM area of application, are encouraged to cooperate in joint actions undertaken in accordance with applicable international obligations (i.e. Article 63 of UNCLOS).

[b] Species included in Annex III (species whose exploitation is regulated) of the Barcelona Convention – Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean.

Annex 3. Fleet segments

3) Fleet segments				
Vessel groups	**Length classes (LOA)**			
Small-scale vessels without engine using passive gear	< 6 m	6–12 m	12–24 m	> 24 m
Small-scale vessels with engine using passive gear	< 6 m	6–12 m	12–24 m	> 24 m
Polyvalent vessels	< 6 m	6–12 m	12–24 m	> 24 m
Purse seiners	< 6 m	6–12 m	12–24 m	> 24 m
Tuna seiners	< 6 m	6–12 m	12–24 m	> 24 m
Dredgers	< 6 m	6–12 m	12–24 m	> 24 m
Beam trawlers	< 6 m	6–12 m	12–24 m	> 24 m
Pelagic trawlers	< 6 m	6–12 m	12–24 m	> 24 m
Trawlers	< 6 m	6–12 m	12–24 m	> 24 m
Longliners	< 6 m	6–12 m	12–24 m	> 24 m

Notes:

– The fleet segments are a combination of vessel groups and length classes.

– A vessel is assigned to a group on the basis of the dominant gear used in terms of percentage of time: more than 50 percent of the time at sea using the same fishing gear during the year.

– "Polyvalent vessels" are defined as all the vessels using more than one gear, with a combination of passive and active gear, none of which exceeding more than 50 percent of the time at sea during the year.

– A vessel is considered "active" when it executes at least one fishing operation during the reference year in the GFCM area of application.

Source: Modified from GFCM, 2018a

Annex 4. Template for discard data

ANNEX 4.a. VESSEL CHARACTERISTICS

4.a) Vessel characteristics					
Name of data collector(s)					
Date					
ID. Fishing trip					
Country					
GSA					
					Notes
Vessel name*					
Fleet segment					
Total length of the vessel					
Power (kW)					
Gross tonnage (GT)					
Port of departure					
Port of arrival					
Gear specifications					
	1st gear	2nd gear	3rd gear	4th gear	**Notes**
Gear type					
Net length (m)					
Mesh size (codend – mm)					
Number of hooks					
Bait					
Number of lines					
Number of pots/traps					
Soak time (the time during which the fishing gear is actively in the water)					
Others					

*if available.

Instructions:

– GSA: Insert the code of the geographical subarea (GSA) as in Annex 1.

– ID. Fishing trip: Identification code that should be assigned to each fishing trip (unique).

– Fleet segment: Insert the fleet segment code (i.e. vessel group + length class) as in Annex 3.

– Gear type: Insert the code of the fishing gear, as reported in Annex 14 (e.g. GNS). If different gears have been used during the same fishing trip, insert each code separately in the different columns. Then, based on the type of gear, provide the different measures of effort (e.g. mesh size, number of hooks) in the corresponding column.

ANNEX 4.b. FISHING TRIP DATA

4.b) Fishing trip data			
Date			
ID. Fishing trip			
			Notes
Total number of fishing operations			
Fishing hours			
Number of fishing operations sampled			
General information on the catch composition			**Notes**
Total landing (kg)			
Main commercial species in the landing fraction			
Discard (kg and percentage) in the catch composition	kg	%	**Notes**
Main species in the discarded fraction			
Catch of vulnerable species (Y/N)			
Catch of non-indigenous species (Y/N)			
Marine litter (Y/N)			
Macrobenthos (Y/N)			

Instructions:

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (as in Annex 4.a).

– Total number of fishing operations: Insert the total number of fishing operations carried out during the same fishing trip.

– Fishing hours: Insert the total number of fishing hours carried out during the same fishing trip (i.e. summing up the hours of all different fishing operations).

– Number of fishing operations sampled: Insert the total number of fishing operations sampled during the same fishing trip. Information on single fishing operation should be then reported in Annex 4.c.

– Total landing (kg): Insert the total landing (or an estimate) in kilograms of the commercial species caught during the same fishing trip.

– Main commercial species in the landing fraction: Insert the name (preferably the scientific name; otherwise, the common one) of the main commercial species present in the landed fraction.

– Discard (kg and percentage) in the catch composition: Insert the total discarded fraction (or an estimate) cumulated during that same fishing trip in kilograms (kg) and in percentage (%).

– Main species in the discarded fraction: Insert the name (preferably the scientific name; otherwise, the common name) of the main species discarded.

– Catch of vulnerable species (Y/N): Indicate "Yes" if, during the fishing trip, any vulnerable species (Annex 10) has been caught; otherwise, indicate "No". If "Yes", detailed data, possibly by single fishing operation, should then be reported in the ad hoc template (Annex 9).

– Catch of non-indigenous species (Y/N): Indicate "Yes" if, during the same fishing trip, any indigenous species has been caught; otherwise, indicate "No". If Yes, detailed data, possibly by single fishing operation, should then be reported in the ad hoc template (Annex 11).

– Marine litter (Y/N): Insert "Yes" if, during the same fishing trip, marine litter has been caught; otherwise, insert No. If Yes, detailed data, possibly by single fishing operation, should then be reported in the ad hoc template (Annex 12).

– Macrobenthos (Y/N): Indicate "Yes" if, during the same fishing trip, any species pertaining to macrobenthos (e.g. sponges, corals, echinoderms, etc.) has been caught; otherwise, indicate "No". If Yes, detailed data, possibly by single fishing operation, should then be reported in the ad hoc template (Annex 13).

ANNEX 4.c. INFORMATION ON EACH OBSERVED FISHING OPERATION

4.c) Fishing operation					
Date		**ID. Fishing operation**			
ID. Fishing trip		**Bottom depth (in meters)**			
Coordinates of the fishing operation*	**Latitude (start)***		**Latitude (end)***		
	Longitude (start)*		**Longitude (end)***		

	Species	**Total weight of the retained fraction (kg)***	**Total weight of the discarded fraction (kg)***	**Length data collected**		**Other biological data collected**		**Notes**
				Retained fraction (Y/N)	Discarded fraction (Y/N)	Retained fraction (Y/N)	Discarded fraction (Y/N)	
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								

*if available.

Note: Data should be reported for each species (commercialized and/or discarded) caught during each single fishing operation. When the specimens cannot be identified at the species level, the family or the genus should be indicated.

Instructions:

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (as in Annex 4.a).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (following a progressive numbering).

– Bottom depth (in metres): Insert the mean depth in metres (or a range from xx to yy) for the same fishing operation.

– Species: Insert the scientific name of the reported species.

– Latitude (start and end) of fishing operation: Insert the latitude at the beginning and at the end of each fishing operation (e.g. fishing hauls). Data should be inserted in degree, minutes and seconds (e.g. 40°51'59"N).

– Longitude (start and end) of fishing operation: Insert the longitude at the beginning and at the end of each fishing operation (e.g. fishing hauls). Data should be inserted in degree, minutes and seconds (e.g. 124°4'58"W).

– Total weight of the retained fraction (kg): For the identified species, insert the total weight, in kilograms (kg), or an estimate of the retained fraction (if present) for the same fishing operation.

– Total weight of the discarded fraction (kg): For the identified species, insert the total weight, in kilograms (kg), or an estimate, of the discarded fraction (if present) for the same fishing operation.

– Length data collected (Y/N): For each species caught during the same fishing operation, indicate "Yes" if length data have been collected for both the retained and/or the discarded fraction; otherwise, indicate "No". If Yes, detailed data should then be reported in the ad hoc template (Annex 7).

– Other biological data collected (Y/N): for each species caught during the same fishing operation, indicate "Yes" if other biological data (i.e. sex and maturity) have been collected for both the retained and/or the discarded fraction; otherwise, indicate "No". If Yes, detailed data should then be reported in the ad hoc template (Annex 8).

Annex 5. Self-sampling reporting form

ANNEX 5.a. VESSEL CHARACTERISTICS AND CATCH DATA

5.a) Self-sampling data: vessel characteristics and catch data					
Country					
GSA					
Date					
Identification number of the fishing trip					
Fleet segment					
					Notes
Vessel name*					
Port of departure					
Port of arrival					
Total length of the vessel					
Power (kW)					
Gross tonnage (GT)					
Total number of fishing operations					
Number of fishing operations sampled					
Gear specifications					
	1st gear	**2nd gear**	**3rd gear**	**4th gear**	**Notes**
Gear type					
Net length (m)					
Mesh size (codend – mm)					
Number of hooks					
Bait					
Number of lines					
Number of pots/traps					
Soak time (the time during which the fishing gear is actively in the water)					
Others					
General information on the catch composition					**Notes**
Total landing (kg)					
Main commercial species in the landing fraction					
Discard (kg and percentage), in the catch composition	kg		%		**Notes**
Main species in the discarded fraction					
Catch of vulnerable species (Y/N)					
Catch of non-indigenous species (Y/N)					
Marine litter (kg and percentage), in the catch composition	kg		%		**Notes**

Instructions:

– GSA: Insert the code of the geographical subarea (GSA) as in Annex 1.

– Identification number of the fishing trip: Identification code that should be assigned to each self-sampled fishing trip (unique).

– Total number of fishing operations: Insert the total number of fishing operations carried out during the same fishing trip.

– Number of fishing operations sampled: Insert the total number of fishing operations sampled during the same fishing trip. Information on single fishing operation should be then reported in Annex 5.a.

– Gear type: Insert the code of the fishing gear, as reported in Annex 14 (e.g. GNS). If different gears have been used during the same fishing trip, insert each code separately in the different columns. Then, based on the type of gear, provide the different measures of effort (e.g. mesh size, number of hooks) in the corresponding column.

– Total landing (kg): Insert the total landing in kilograms (or an estimate) of the commercial species caught during the same fishing trip.

– Main commercial species in the landing fraction: Insert the name (preferably the scientific name; otherwise, the common name) of the main commercial species present in the catch.

– Discard (kg and percentage), in the catch composition: Insert the total discarded fraction (or an estimate) cumulated during that fishing trip in kilograms (kg) and in percentage (%).

– Main species in the discarded fraction: Insert the name (preferably the scientific name; otherwise, the common name) of the main species discarded.

– Catch of vulnerable species (Y/N): Insert "Yes" if during the same fishing trip there has been bycatch of vulnerable species (in this case, the information, per different group of species, should be reported in Annex 9); otherwise, insert "No".

– Catch of non-indigenous species (Y/N): Insert "Yes" if during the same fishing trip there has been catch of non-indigenous species (in this case, the information should be reported in Annex 11); otherwise, insert "No".

– Marine litter, (kg and percentage), in the catch composition: Insert the total marine litter fraction (or an estimate) cumulated during the same fishing trip in kilograms (kg) and in percentage (%).

ANNEX 5.b. FISHING OPERATION CHARACTERISTICS

5.b) Self-sampling data: fishing operation								
Date				**Identification number of the self-sampling fishing operation**				
Identification number of the fishing trip				**Bottom depth (in meters)**				
	Species	**Total weight of the retained fraction (kg)***	**Total weight of the discarded fraction (kg)***	**Specimens preserved for biological observations***		**Weight (kg) of subsample taken from the retained fraction***	**Weight (kg) of subsample taken from the discarded fraction***	**Notes**
				Retained fraction (Y/N)	Discarded fraction (Y/N)			
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
Comments								

*if available

Note: Data should be reported for each species (commercialized and/or discarded) caught during each single fishing operation. When the specimens cannot be identified at the species level, the family or the genus should be indicated.

Instructions:

- Identification number of the fishing trip: Provide the identification code that has been assigned to each self-sampled fishing trip (as in Annex 5.a).
- Identification number of the self-sampling fishing operation: Provide the identification code that has been assigned to each fishing observation during the same self-sampled fishing trip (progressive numbering).
- Bottom depth (in metres): Insert the mean depth in metres (or a range from xx to yy) for the same fishing operation.
- Species: Insert the scientific name of the reported species.
- Total weight of the retained fraction (kg): For the identified species, insert the total weight in kilograms (kg), or an estimate of the retained fraction (if present) for that fishing operation.
- Total weight of the discarded fraction (kg): For the identified species, insert the total weight, in kilograms (kg), or an estimate, of the discarded fraction (if present) for that fishing operation.
- Specimens preserved for biological observations: Insert "Y" for Yes or "N" for No when specimens are brought to the landing place for further analysis, separating the retained from the discarded fraction. Then, for each identified species, report the weight (kg) or an estimate of the subsample taken from the retained fraction and the weight (kg), or an estimate, of the subsample taken from the discarded fraction.

Annex 6. Questionnaire form

ANNEX 6.a. QUESTIONNAIRE ON GENERAL INFORMATION ON DISCARDS

6.a) Questionnaire on general information on discards			
Interviewer			
Date of the interview			
Port			
ID. Questionnaire			
ID. Vessel			
Vessel characteristic			
Name of the vessel:		Fleet segment:	
Vessel length (m):		kW:	GT:
Gear characteristic			
Gear(s):		Mesh size:	
Length:		Number of pots and traps:	
Number of net(s):		Others info:	
Number of hook(s):			
Fishing behaviour			
Number of fishing days (during one year):			
Main target species:			
Main target species by season: Winter:		Spring:	
Summer:		Autumn:	
Discard? (y/n)			
Discard estimates (%) vs total catch by year:			
Is there a seasonality for discard (y/n)?			
Main discarded species by season: Winter:		Spring:	
Summer:		Autumn:	
Reason(s) for discarding		*Species*	
Low commercial value			
Small specimens			
Poor condition			
Forbidden by law			
Others			

ANNEX 6.b. QUESTIONNAIRE BY FISHING TRIP

6.b) Questionnaire by fishing trip					
Date of the interview					
ID. Questionnaire					
ID. Vessel					
Date of the fishing trip					
Port of departure					
Port of arrival					
Total number of fishing operations					
Information on fishing area (e.g. depth range, position, sea bottom etc.)					
Gear specifications					
	1st gear	**2nd gear**	**3rd gear**	**4th gear**	**Notes**
Gear type					
Net length (m)					
Mesh size (codend – mm)					
Number of hooks					
Bait					
Number of lines					
Number of pots/traps					
Soak time (the time during which the fishing gear is actively in the water)					
Other gear information					
General information on the catch composition during that fishing trip					
Total landing (kg)					
Main target species in the catch					
Discard (kg and percentage), in the catch composition	kg		%		
Main species in the discard fraction					
Discards species composition					
Species or family/genus/order/taxa	Total weight (kg)		Notes/Description		
Marine litter (kg and percentage), in the catch composition	**kg**		**%**		
Do you catch any of the following group of vulnerable species during your fishing trip?	Yes/No		Species		
Dolphins and whales					
Seals					
Sharks and rays					
Seabirds					
Sea turtles					
Additional Comments					

Annex 7. Template for length data

ANNEX 7.a. LENGTH DATA TEMPLATE FOR FISH, ELASMOBRANCHS AND CEPHALOPODS (BY SPECIES AND FISHING OPERATION)

7.a) Length data (fish, elasmobranchs and cephalopods)				
Species				
Date		**ID. Fishing trip**		
Source of data		**ID. Fishing operation**		
Length (cm)	**Retained fraction***		**Discarded fraction***	**Notes**
	Subsample (Y/N)		**Subsample (Y/N)**	
0				
0.5				
1				
1.5				
2				
2.5				
3				
3.5				
4				
4.5				
5				
5.5				
6				
6.5				
7				
7.5				
8				
8.5				
9				
9.5				
0				
0.5				
1				
1.5				
2				
2.5				
3				
3.5				
4				
4.5				
5				
5.5				
6				
6.5				
7				
7.5				
8				
8.5				
9				
9.5				
0				
Weight of the subsample (kg)*				
Total weight (kg) both for the retained and/or discarded fraction				

*if present.

Notes:

– This template should be replicated for the different species caught during the same fishing operation.

– For the considered species and for each fishing operation, the total weight (in kg) of the subsample (if present) and the total weight (in kg) of the catch (always divided for both fractions, i.e. retained and discarded) should then be reported.

– Indicate for both fractions, retained (when present) and discarded (when present), if the collected length measures are a subsample of the whole catch ("Yes") or not ("No").

Instructions:

– Species: Insert the scientific name of the reported species.

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

– Retained fraction: Indicate with "Yes" or "No" if the measures of the specimens, both from retained and/or discarded fractions, are a subsample from the whole catch.

– Weight of the subsample (kg): By species and fishing operation, insert the total weight (in kg) or an estimate of the subsample fraction, both for the retained (if present) and/or discarded fraction (if present).

– Total weight (kg) both for the retained and/or discarded fraction: By species and fishing operation, insert the total weight (in kg), or an estimate, both for the retained (if present) and/or discarded fraction (if present).

ANNEX 7.b. LENGTH DATA TEMPLATE FOR CRUSTACEANS (BY SPECIES AND FISHING OPERATION)

7.b) Length data (crustaceans)					
Species					
Date			**ID. Fishing trip**		
Source of data			**ID. Fishing operation**		
Length (cm)	**Retained fraction***		**Discarded fraction***		**Notes**
	Subsample (Y/N)		**Subsample (Y/N)**		
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
1					
2					
3					
4					
5					
6					
7					
8					
9					
0					
Weight of the subsample (kg)*					
Total weight (kg) both for the retained and/or discarded fraction					

*if present.

Notes:

– This template should be replicated for the different species caught during the same fishing operation.

– For the considered species and for each fishing operation, the total weight (in kg) of the subsample (if present) and the total weight (in kg) of the catch (always divided for both fractions, i.e. retained and discarded) should then be reported.

– Indicate for both fractions, retained (when present) and discarded (when present), if the collected length measures are a subsample of the whole catch (“Yes”) or not (“No”).

Instructions:

- Species: Insert the scientific name of the reported species.
- Source of data: Indicate if the data come from on-board observations, self-sampling, etc.
- ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).
- ID. Fishing operation: Provide the identification code which has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).
- Retained fraction: Indicate with a "Y" for Yes (Y) or "N" for No if the measures of the specimens, both from retained and/or discarded, are a subsample from the whole catch.
- Weight of the subsample (kg): By species and fishing operation, insert the total weight (kg) or an estimate of the subsample fraction both for the retained (if present) and/or discarded fraction (if present).
- Total weight (kg) both for the retained and/or discarded fraction: By species and fishing operation, insert the total weight (kg), or an estimate, both for the retained (if present) and/or discarded fraction (if present).

Annex 8. Template for other biological data

ANNEX 8.a. SEX AND MATURITY DATA FOR BONY FISH (BY SPECIES AND FISHING OPERATION)

8.a) Sex and maturity data (bony fish)			
Species		**Retained or discarded fraction**	
Date		**ID. Fishing trip**	
Source of data		**ID. Fishing operation**	

TL (cm)	Males							TL (cm)	Females							TL (cm)	Undetermined/Not Determined
	1	2			3	4			1	2			3	4			
	1	2a	2b	2c	3	4a	4b		1	2a	2b	2c	3	4a	4b		
0								0								0	
0.5								0.5								0.5	
1								1								1	
1.5								1.5								1.5	
2								2								2	
2.5								2.5								2.5	
3								3								3	
3.5								3.5								3.5	
4								4								4	
4.5								4.5								4.5	
5								5								5	
5.5								5.5								5.5	
6								6								6	
6.5								6.5								6.5	
7								7								7	
7.5								7.5								7.5	
8								8								8	
8.5								8.5								8.5	
9								9								9	
9.5								9.5								9.5	
0								0								0	
0.5								0.5								0.5	
1								1								1	
1.5								1.5								1.5	
2								2								2	
2.5								2.5								2.5	
3								3								3	
3.5								3.5								3.5	
4								4								4	
4.5								4.5								4.5	
5								5								5	
5.5								5.5								5.5	
6								6								6	

6.5								6.5							**6.6**	
7								7							**7**	
7.5								7.5							**7.5**	
8								8							**8**	
8.5								8.5							**8.5**	
9								9							**9**	
9.5								9.5							**9.5**	
0								0							**0**	
0.5								0.5							**0.5**	
1								1							**1**	
1.5								1.5							**1.5**	
2								2							**2**	
2.5								2.5							**2.5**	
3								3							**3**	
3.5								3.5							**3.5**	
4								4							**4**	
4.5								4.5							**4.5**	
5								5							**5**	
5.5								**5.5**							**5.5**	
6								**6**							**6**	
6.5								**6.5**							**6.5**	
7								**7**							**7**	
7.5								**7.5**							**7.5**	
8								**8**							**8**	
8.5								**8.5**							**8.5**	
9								**9**							**9**	
9.5								**9.5**							**9.5**	
0								**0**							**0**	

Comments

Notes:

– Maturity information should be reported based on maturity scales as in the DCRF provisions (Annex G.1 of the DCRF manual – GFCM, 2018a).

– This template should be replicated for each species caught during the same fishing operation, for which the requested information should be collected (both for the retained and/or discarded fractions).

Instructions:

– Species: Insert the scientific name of the reported species.

– Retained or discarded: Indicate if for the identified species, the data (i.e. length by sex and maturity stage) refer to the discarded or retained fraction of the catch. When the data for the same species have been collected for both fractions, information should be reported in two different templates.

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

ANNEX 8.b. SEX AND MATURITY DATA FOR CEPHALOPODS (BY SPECIES AND FISHING OPERATION)

8.b) Sex and maturity data (cephalopods)			
Species		**Retained or discarded fraction**	
Date		**ID. Fishing trip**	
Source of data		**ID. Fishing operation**	

ML (cm)	Males					ML (cm)	Females					ML (cm)	Undetermined/Not Determined
	1	2		3			1	2		3			
	1	2a	2b	3a	3b		1	2a	2b	3a	3b		
0						0						**0**	
0.5						0.5						**0.5**	
1						1						**1**	
1.5						1.5						**1.5**	
2						2						**2**	
2.5						2.5						**2.5**	
3						3						**3**	
3.5						3.5						**3.5**	
4						4						**4**	
4.5						4.5						**4.5**	
5						5						**5**	
5.5						5.5						**5.5**	
6						6						**6**	
6.5						6.5						**6.5**	
7						7						**7**	
7.5						7.5						**7.5**	
8						8						**8**	
8.5						8.5						**8.5**	
9						9						**9**	
9.5						9.5						**9.5**	
0						0						**0**	
0.5						0.5						**0.5**	
1						1						**1**	
1.5						1.5						**1.5**	
2						2						**2**	
2.5						2.5						**2.5**	
3						3						**3**	
3.5						3.5						**3.5**	
4						4						**4**	
4.5						4.5						**4.5**	
5						5						**5**	
5.5						5.5						**5.5**	
6						6						**6**	
6.5						6.5						**6.5**	
7						7						**7**	
7.5						7.5						**7.5**	
8						8						**8**	
8.5						8.5						**8.5**	

9						9						**9**	
9.5						9.5						**9.5**	
0						0						**0**	
0.5						0.5						**0.5**	
1						1						**1**	
1.5						1.5						**1.5**	
2						2						**2**	
2.5						2.5						**2.5**	
3						3						**3**	
3.5						3.5						**3.5**	
4						4						**4**	
4.5						4.5						**4.5**	
5						5						**5**	
5.5						**5.5**						**5.5**	
6						**6**						**6**	
6.5						**6.5**						**6.5**	
7						**7**						**7**	
7.5						**7.5**						**7.5**	
8						**8**						**8**	
8.5						**8.5**						**8.5**	
9						**9**						**9**	
9.5						**9.5**						**9.5**	
0						**0**						**0**	
Comments													

Notes:

– Maturity information should be reported based on maturity scales as in the DCRF provisions (Annex G.2 of the DCRF manual – GFCM, 2018a).

– This template should be replicated for each species caught during the same fishing operation, for which the requested information should be collected (both for the retained and/or discarded fractions).

Instructions:

– Species: Insert the scientific name of the reported species.

– Retained or discarded: Indicate if for the identified species, the data (i.e. length by sex and maturity stage) refer to the discarded or retained fraction of the catch. When the data for the same species have been collected for both fractions, information should be reported in two different templates.

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

ANNEX 8.c. SEX AND MATURITY DATA FOR CRUSTACEANS (BY SPECIES AND FISHING OPERATION)

8.c) Sex and maturity data (crustaceans)			
Species		**Retained or discarded fraction**	
Date		**ID. Fishing trip**	
Source of data		**ID. Fishing operation**	

CL (mm)	Males	CL (mm)	Females					CL (mm)	Undetermined/Not Determined
	0		1	2	3	4	5		
0		0						0	
1		1						1	
2		2						2	
3		3						3	
4		4						4	
5		5						5	
6		6						6	
7		7						7	
8		8						8	
9		9						9	
10		10						10	
11		11						11	
12		12						12	
13		13						13	
14		14						14	
15		15						15	
16		16						16	
17		17						17	
18		18						18	
19		19						19	
20		20						20	
21		21						21	
22		22						22	
23		23						23	
24		24						24	
25		25						25	
26		26						26	
27		27						27	
28		28						28	
29		29						29	
30		30						30	
31		31						31	
32		32						32	
33		33						33	
34		34						34	
35		35						35	
36		36						36	
37		37						37	

38		38						38	
39		39						39	
40		40						40	
41		41						41	
42		42						42	
43		43						43	
44		44						44	
45		45						45	
46		46						46	
47		47						47	
48		48						48	
49		49						49	
50		50						**50**	
51		51						**51**	
52		52						**52**	
53		53						**53**	
54		54						**54**	
55		55						**55**	
56		56						**56**	
57		57						**57**	
58		58						**58**	
59		59						**59**	
60		60						**60**	
Comments:									

Notes:

– Maturity information should be reported based on maturity scales as in the DCRF provisions (Annex G.3 of the DCRF manual – GFCM, 2018a).

– This template should be replicated for each species caught during the same fishing operation, for which the requested information should be collected (both for the retained and/or discarded fractions).

Instructions:

– Species: Insert the scientific name of the reported species.

– Retained or discarded: Indicate if for the identified species, the data (i.e. length by sex and maturity stage) refer to the discarded or retained fraction of the catch. When the data for the same species have been collected for both fractions, information should be reported in two different templates.

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

ANNEX 8.d. SEX AND MATURITY DATA FOR ELASMOBRANCHS (BY SPECIES AND FISHING OPERATION)

8.d) Sex and maturity data (elasmobranchs)			
Species		**Retained or discarded fraction**	
Date		**ID. Fishing trip**	
Source of data		**ID. Fishing operation**	
Total length (cm)	**Male (M), Female (F), Undetermined (U), Not Determined (ND)**	**Maturity stage**	**Notes**
Comments:			

Notes:

– Maturity information should be reported based on maturity scales as in the DCRF provisions (Annex G.4 of the DCRF manual – GFCM, 2018a).

– This template should be replicated for each species caught during the same fishing operation, for which the requested information should be collected (both for the retained and/or discarded fractions).

Instructions:

– Species: Insert the scientific name of the reported species.

– Retained or discarded: Indicate if for the identified species, the data (i.e. length by sex and maturity stage) refer to the discarded or retained fraction of the catch. When the data for the same species have been collected for both fractions, information should be reported in two different templates.

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

Annex 9. Template for vulnerable species

9) Data on vulnerable species				
Source of data				
Date				
ID. Fishing trip				
ID. Fishing operation*				
				Notes
Time of starting operation*				
Time of ending operation*				
Latitude (start and end) of the fishing operation*				
Longitude (start and end) of the fishing operation*				
Gear type				
Depth (in meters)*				
Vulnerable species caught				
	Species 1	**Species 2**	**Species 3**	**Notes**
Group of vulnerable species				
Family*				
Genus*				
Species				
Photo (Y/N)*				
Total number of individual(s) caught				
Total weight of individual(s) caught (kg)*				
Condition at capture*				
alive				
dead				
almost dead				
not known				
Condition at release*				
alive				
dead				
almost dead				
not known				

* if available.

Notes:

– Collected data should preferably be reported on a single fishing operation; otherwise, they can be aggregated at the fishing trip level.

– This template can be replicated for each fishing operation carried out during the same fishing trip.

– Data should be reported by species or by genus and/or family if the detailed information by species is not available.

Instructions:

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

– Latitude (start and end) of fishing operation: Insert the latitude at the beginning and at the end of each fishing operation (e.g. fishing hauls). Data should be inserted in degree, minutes and seconds (e.g. 40°51'59"N).

– Longitude (start and end) of fishing operation: Insert the longitude at the beginning and at the end of each fishing operation (e.g. fishing hauls). Data should be inserted in degree, minutes and seconds (e.g. 124°4'58"W).

– Gear type: Insert the code of the fishing gear, as reported in Annex 14 (e.g. GNS).

– Depth (in meters): Mean depth or depth range (from xx m to xx m), in meters (m), of the single fishing operation. (If information is reported at the fishing trip level, insert the mean depth of the fishing trip).

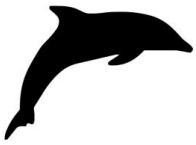
– Photo (Y/N): Indicate "Yes" if a photo of the specimen has been taken, and if any, indicate the photo with an identification code; otherwise insert "No".

– Total weight of individual(s) caught: Whenever possible, for each group of vulnerable species caught, report the total weight in kilograms of the individual(s) caught or insert an estimate.

– Condition at capture and condition at release: For each species, indicate the number of individuals that has been caught and released *alive, dead, almost dead* or indicate that the state is *not known.*

Annex 10. List of vulnerable species

a) Vulnerable species. List of vulnerable species included in Annex II (endangered or threatened species) and Annex III (species whose exploitation is regulated) of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention). The list also contains the amendments to Annexes II and III of the Protocol concerning specially protected areas and biological diversity in the Mediterranean (2012/510/EU: Council Decision of 10 July 2012, establishing the position to be adopted on behalf of the European Union with regard to the amendments to Annexes II and III to the Protocol concerning Specially Protected Areas and Biological Diversity [SPA/BD Protocol] in the Mediterranean of the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, adopted by the Seventeenth Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols, Paris, France, 8–10 February 2012).

Group of vulnerable species	Family	Species	Common name
Cetaceans 	Balaenopteridae	*Balaenoptera acutorostrata*	Common minke whale
		Balaenoptera borealis	Sei whale
		Balaenoptera physalus	Fin whale
		Megaptera novaeangliae	Humpback whale
	Balaenidae	*Eubalaena glacialis*	North Atlantic right whale
	Physeteridae	*Physeter macrocephalus*	Sperm whale
		Kogia sima	Dwarf sperm whale
	Phocoenidae	*Phocoena phocoena*	Harbour porpoise
	Delphinidae	*Steno bredanensis*	Rough-toothed dolphin
		Grampus griseus	Risso's dolphin
		Tursiops truncatus	Common bottlenose dolphin
		Stenella coeruleoalba	Striped dolphin
		Delphinus delphis	Common dolphin
		Pseudorca crassidens	False killer whale
		Globicephala melas	Long-finned pilot whale
		Orcinus orca	Killer whale
	Ziphiidae	*Ziphius cavirostris*	Cuvier's beaked whale
		Mesoplodon densirostris	Blainville's beaked whale
Seals	Phocidae	*Monachus monachus*	Mediterranean monk seal

Group of vulnerable species	Family	Species	Common name
Sharks, Rays, Chimaeras 	Alopiidae	*Alopias vulpinus*	Common thresher
	Carcharhinidae	*Carcharhinus plumbeus*	Sandbar shark
		Carcharodon carcharias	Great white shark
		Prionace glauca	Blue shark
	Centrophoridae	*Centrophorus granulosus*	Gulper shark
	Cetorhinidae	*Cetorhinus maximus*	Basking shark
	Gymnuridae	*Gymnura altavela*	Spiny butterfly ray
	Hexanchidae	*Heptranchias perlo*	Sharpnose sevengill shark
	Lamnidae	*Isurus oxyrinchus*	Shortfin mako
		Lamna nasus	Porbeagle
	Myliobatidae	*Mobula mobular*	Devil fish
	Odontaspididae	*Carcharias taurus*	Sand tiger
		Odontaspis ferox	Small-tooth sand tiger shark
	Oxynotidae	*Oxynotus centrina*	Angular rough shark
	Pristidae	*Pristis pectinata*	Smalltooth sawfish
		Pristis pristis	Common sawfish
	Rajidae	*Dipturus batis*	Blue skate
		Leucoraja circularis	Sandy ray
		Leucoraja melitensis	Maltese skate
		Rostroraja alba	White skate
	Rhinobatidae	*Rhinobatos cemiculus*	Blackchin guitarfish
		Rhinobatos rhinobatos	Common guitarfish
	Sphyrnidae	*Sphyrna lewini*	Scalloped hammerhead
		Sphyrna mokarran	Great hammerhead
		Sphyrna zygaena	Smooth hammerhead
	Squatinidae	*Squatina aculeata*	Sawback angelshark
		Squatina oculata	Smoothback angelshark
		Squatina squatina	Angelshark
	Triakidae	*Galeorhinus galeus*	School/Tope shark

Group of vulnerable species	Family	Species	Common name
Seabirds 	Falconidae	*Falco eleonorae*	Eleonora's falcon
	Alcedinidae	*Ceryle rudis*	Pied kingfisher
		Halcyon smyrnensis	White-throated kingfisher
	Charadriidae	*Charadrius alexandrinus*	Kentish plover
		Charadrius leschenaultii columbinus	Greater sand plover
	Hydrobatidae	*Hydrobates pelagicus melitensis**	European storm-petrel (Mediterranean)
		*Hydrobates pelagicus**	European storm-petrel
	Laridae	*Larus audouinii**	Audouin's gull
		*Larus armenicus**	Armenian gull
		*Larus genei**	Slender-billed gull
		*Larus melanocephalus**	Mediterranean gull
		*Sternula albifrons**	Little tern
		*Thalasseus bengalensis**	Lesser crested tern
		*Thalasseus sandvicensis**	Sandwich tern
		*Hydroprogne caspia**	Caspian tern
		*Gelochelidon nilotica**	Common Gull-billed tern
	Pandionidae	*Pandion haliaetus*	Osprey
	Pelecanidae	*Pelecanus crispus*	Dalmatian pelican
		Pelecanus onocrotalus	Great white pelican
	Phalacrocoracidae	*Gulosus aristotelis desmarestii*	European shag (Mediterranean)
		Microcarbo pygmaeus	Pygmy cormorant
	Phoenicopteridae	*Phoenicopterus roseus*	Greater flamingo
	Procellariidae	*Calonectris diomedea**	Scopoli's shearwater
		*Calonectris borealis**	Cory's shearwater
		*Puffinus yelkouan**	Yelkouan shearwater
		*Puffinus mauretanicus**	Balearic shearwater
	Scolopacidae	*Numenius tenuirostris*	Slender-billed curlew

* The only birds which can be considered as seabirds. The other species in the table are mentioned as "aves" in Annex II of the Barcelona Convention. Some of them belong to the so-called water-bird or aquatic bird (e.g. birds that inhabit or depend on bodies of water or wetland areas).

Group of vulnerable species	Family	Species	Common name
Sea turtles 	Cheloniidae	*Caretta caretta*	Loggerhead turtle
		Chelonia mydas	Green turtle
		Eretmochelys imbricata	Hawksbill Turtle
		Lepidochelys kempii	Kemp's ridley sea turtle
		Lepidochelys olivacea	Olive ridley sea turtle
	Dermochelyidae	*Dermochelys coriacea*	Leatherback sea turtle
	Trionychidae	*Trionyx triunguis*	African softshell turtle

b) Rare elasmobranch species. This list reports elasmobranch species that are included in the IUCN Red List of Threatened species (www.iucnredlist.org) or that are considered rare in the Mediterranean and the Black Sea (Bradai, Saidi and Enajjar, 2012). www.iucnssg.org/iucnredlist.html

Group of rare species	Family	Species	Common name
Sharks, Rays, Chimaeras 	Alopiidae	*Alopias superciliosus*	Bigeye thresher
	Hexanchidae	*Hexanchus nakamurai*	Bigeyed sixgill shark
	Echinorhinidae	*Echinorhinus brucus*	Bramble shark
	Squalidae	*Squalus megalops*	Shortnose spurdog
	Centrophoridae	*Centrophorus uyato*	Little gulper shark
	Somniosidae	*Centroscymnus coelolepis*	Portugese dogfish
		Somniosus rostratus	Little sleeper shark
	Lamnidae	*Isurus paucus*	Longfin mako
	Scyliorhinidae	*Galeus atlanticus*	Atlantic sawtail catshark
	Carcharhinidae	*Carcharhinus altimus*	Bignose shark
		Carcharhinus brachyurus	Bronze whaler shark
		Carcharhinus brevipinna	Spinner shark
		Carcharhinus falciformis	Silky shark
		Carcharhinus limbatus	Blacktip shark
		Carcharhinus melanopterus	Blacktip reef shark
		Carcharhinus obscurus	Dusky shark
		Galeocerdo cuvier	Tiger shark
		Rhizoprionodon acutus	Milk shark
	Torpedinidae	*Tetronarce nobiliana*	Great torpedo ray
		Torpedo sinuspersici	Variable torpedo ray
	Rajidae	*Dipturus nidarosiensis*	Norwegian skate
		Leucoraja fullonica	Shagreen skate
		Leucoraja naevus	Cuckoo skate
		Raja brachyura	Blonde skate
		Raja montagui	Spotted skate
		Raja polystigma	Speckled skate
		Raja radula	Rough skate
		Raja undulata	Undulate skate
	Dasyatidae	*Bathytoshia centroura*	Roughtail stingray
		Dasyatis marmorata	Marbled stingray
		Dasyatis pastinaca	Common stingray
		Dasyatis tortonesei	Tortonese's stingray
		Himantura uarnak	Honeycomb whipray
		Taeniurops grabata	Round stingray
	Myliobatidae	*Aetomylaeus bovinus*	Bullray
	Rhinopteridae	*Rhinoptera marginata*	Lusitanian cownose ray
	Sphyrnidae	*Sphyrna tudes*	Smalleye hammerhead

Annex 11. Template for non-indigenous species

11) Data on non-indigenous species	
Source of data	
Date	
ID. Fishing trip	
ID. Fishing operation*	
Gear type	
Species (latin name)*	
Common name	
Commercial (Y/N)	
Total number of individuals caught	
Total weight (kg) of individual(s) caught	
Percentage of individuals discarded (%)	
Notes:	

*if available

Notes:

– Collected data should be preferably reported on a single fishing operation; otherwise, they can be aggregated at the fishing trip level.

– This template can be replicated for each fishing operation carried out during the same fishing trip.

– Data should be reported by species or by genus and/or family if the detailed information by species is not available.

Instructions:

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

– Gear type: Insert the code of the fishing gear, as reported in Annex 14 (e.g. GNS).

– Commercial (Y/N): Indicate "Yes" if the non-indigenous species has a commercial value; otherwise, indicate "No".

– Total weight (kg) of individual(s) caught: Whenever possible, for each species, report the total weight in kilograms of the individual(s) caught (during the same fishing trip or fishing operation), or insert an estimate.

– Percentage of individuals discarded (%): Indicate in percentage (%) the number of specimens of the particular non-indigenous species that has been rejected at sea during the same fishing trip or fishing operation (do not leave it blank, but rather, report zero values).

Annex 12. Template for marine macro-litter

12) Data on marine macro-litter			
Source of data			
Date			
ID. Fishing trip			
ID. Fishing operation*			**Notes**
Total quantity of marine litter (kg)			
Percentage (%) of marine litter in the catch			
Marine litter composition*	**kg**	**%**	**Notes**
Plastic			
Rubber			
Fishing gear			
Metal			
Glass			
Ceramic			
Cloth			
Wood processed			
Other (please specify)			
Comments:			

*if available

Notes:

– Collected data should preferably be reported on a single fishing operation; otherwise, they can be aggregated at the fishing trip level.

– This template can be replicated for each fishing operation carried out during the same fishing trip.

Instructions:

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

– Total quantity of marine litter (kg): Insert the total weight in kilograms (or an estimate) of marine litter taken during the same fishing trip or fishing operation.

– Percentage (%) of marine litter in the catch: Insert the total marine litter fraction (in percentage) cumulated during the same fishing trip or fishing operation.

– Marine litter composition: Whenever possible, insert the weight (or an estimate) in kilograms (kg) and the percentage of the different items contributing to the marine litter during the same fishing trip or fishing operation.

Annex 13. Template for macrobenthos

13) Data on marine macrobenthos					
Source of data					
Date					
ID. Fishing trip					
ID. Fishing operation*					
					Notes
Total quantity of macroinvertebrates (estimation in kg)					
Percentage of macroinvertebrates in the total catch (%)					
	Feature*	**Habitat***	**Taxa***		**Notes**
VME Indicator*					
Composition by species*					
Species*	**Family/Genus/Order/ Taxa/Morphological group**	**Total weight (kg)**	**Total number**	**Photo (Y/N)***	**Notes**
Comments:					

*if available

Notes:

– Collected data should preferably be reported on a single fishing operation; otherwise, they can be aggregated at the fishing trip level.

– This template can be replicated for each fishing operation carried out during the same fishing trip.

Instructions:

– Source of data: Indicate if the data come from on-board observations, self-sampling, etc.

– ID. Fishing trip: Provide the identification code that has been assigned to each fishing trip (unique) (as in Annex 4.a in case of on-board observation, or as in Annex 5.a in case of self-sampling).

– ID. Fishing operation: Provide the identification code that has been assigned to each fishing observation during the same fishing trip (as in Annex 4.c in case of on-board observation, or as in Annex 5.b in case of self-sampling).

– Total quantity of macroinvertebrates (estimation in kg): Insert the total weight (or an estimate) of macroinvertebrates (macrobenthos) in kilograms taken during the same fishing trip or fishing operation.

– Percentage of macroinvertebrates in the total catch (%): Insert the total macroinvertebrates fraction (in percentage) cumulated during the same fishing trip or fishing operation.

– VME indicator (feature, habitat, taxa): If possible, record this information for each fishing trip and/or fishing operation (please refer to Box 6 – "Section 6.4 Macrobenthos").

– Composition by species: Whenever possible, insert the name of the macrobenthic species. When the specimens cannot be identified at the species level, the genus, family, order or taxa should be indicated. In cases where species identification is not possible (especially for sessile taxa), organisms can be assigned to morphological groups according to their growth form (e.g. massive, tubular, globular, arborescent, stalked, fan-shaped, lollipop-shaped, cup-shaped) combined with information about their colour, consistency (e.g. hard/soft) and photographic documentation.

– Total weight (kg): Insert the total weight in kilograms (or an estimate) for each identified species of benthic marine macroinvertebrates caught during the same fishing trip or fishing operation.

– Total number: Insert the total number (or an estimate) for each identified species of benthic marine macroinvertebrates caught during the same fishing trip or fishing operation.

– Photo (Y/N): Insert "Yes" or "No" if a photo of the specimen has been taken, and if "Yes", assign an identification code to the photo.

Annex 14. List of fishing gear and codes

14) Fishing gear			
Gear Name	**Code**	**Gear Name**	**Code**
Purse seine without purse lines (lampara)	LA	Falling gear (not specified)	FG
Purse seine with purse lines (purse seines)	PS	Gillnets and entangling nets (not specified)	GEN
One boat-operated purse seines	PS1	Gillnets (not specified)	GN
Two boat-operated purse seines	PS2	Encircling gillnets	GNC
Beach seines	SB	Driftnets	GND
Danish seines	SDN	Fixed gillnets (on stakes)	GNF
Pair seines	SPR	Set gillnets (anchored)	GNS
Scottish seines	SSC	Combined gillnets-trammel nets	GTN
Boat or vessel seines	SV	Trammel nets	GTR
Seine nets (not specified)	SX	Aerial traps	FAR
Otter trawls (not specified)	OT	Traps (not specified)	FIX
Bottom otter trawls	OTB	Stationary uncovered pound nets	FPN
Midwater otter trawls	OTM	Pots	FPO
Otter twin trawls	OTT	Stow nets	FSN
Pair trawls (not specified)	PT	Barrier, fences, weirs, etc.	FWR
Bottom pair trawls	PTB	Fyke nets	FYK
Midwater pair trawls	PTM	Handlines and pole-lines (mechanized)	LHM
Bottom trawls	TB	Handlines and pole-lines (hand operated)	LHP
Bottom beam trawls	TBB	Longlines (not specified)	LL
Bottom nephrops trawls	TBN	Drifting longlines	LLD
Bottom shrimp trawls	TBS	Set longlines	LLS
Midwater trawls	TM	Trolling lines	LTL
Midwater shrimp trawls	TMS	Hooks and lines (not specified)	LX
Other trawls (not specified)	TX	Harpoons	HAR
Boat dredges	DRB	Pumps	HMP
Hand dredges	DRH	Mechanized dredges	HMD
Lift nets (not specified)	LN	Harvesting machines (not specified)	HMX
Boat-operated lift nets	LNB	Miscellaneous gear	MIS
Portable lift nets	LNP	Recreational fishing gear	RG
Shore-operated stationary lift nets	LNS	Gear not known or not specified	NK
Cast nets	FCN		

Annex 15. Equipment for observers

- Fish identification guide
- Digital camera
- Board, pencils, eraser and sharpener
- Voice recorder with microphone and earphones, with batteries
- Large knives
- Plastic bags for freezing fish
- Gloves and rubber boots
- Ridged board (with a ruler graduated in mm, cm or ½ cm) to measure fish, small sharks and cephalopods
- Measuring tape to measure large fish, large sharks and elasmobranchs
- Callipers (e.g. mechanical, digital and automatic) to measure crustaceans
- Copies of templates for data reporting (e.g. discards, length data, biological data, non-indigenous species, marine macro-litter)
- Boxes to store collected samples
- Markers to label collected samples
- GPS
- Slates to be used to label the haul when taking photographs
- Medical first aid kit

Discards – the part of the catch that is not retained on board, which may include target species or any other (commercial and non-commercial) species that are returned at sea dead or alive – usually result in a reduction of harvesting opportunities and may have negative consequences on the stocks, ecosystems and the marine environment. In the Mediterranean and the Black Sea, studies on discards only cover a small portion of the total fishing activities and discard rates are often poorly estimated or totally unknown. Information is lacking for many types of fishing gear, countries and GFCM subregions, and most available studies only cover relatively short periods and small areas. Discards therefore represent a major source of uncertainty about the actual fishing mortality rates of stocks. These knowledge gaps highlight the need to expand discard monitoring programmes and standardize practices, so to assess discards appropriately and address their important impacts. This publication and the methodology discussed herein aim to provide a framework for the development and implementation of an efficient, standardized data collection and monitoring system for discards through on-board observations, questionnaires at landing sites and self-sampling activities. It ensures minimum common standards for the collection of discards data and allows for repeatability and comparisons among fisheries across the region, thus offering a harmonized basis of knowledge, information and evidence for decision-making.

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